This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

No.

BOSTON
MEDICAL LIBRARY
ASSOCIATION,
19 BOYLSTON PLACE.

B1 Burrow Coll
2

ARCHIVES

OF

OTOLOGY

EDITED IN ENGLISH AND GERMAN

BY

DR. H. KNAPP
OF NEW YORK

DR. S. MOOS
OF HEIDELBERG

DR. D. B. ST. JOHN ROOSA
OF NEW YORK

AND

DR. C. J. KIPP, NEWARK, N. J.

IN CONJUNCTION WITH

Dr. THOMAS BARR, of Glasgow; Dr. A. BARTH, of Berlin; Prof. E. BERTHOLD, of Königsberg; Dr. O. BRUNNER, of Zurich; Dr. SWAN M. BURNETT, of Washington; Sir W. B. DALBY, of London; Dr. E. FRÄNKEL of Hamburg; Dr. J. GOTTSTEIN, of Breslau; Dr. E. GRUENING, of New York; Dr. A. GUYE, of Amsterdam; Dr. A. HARTMANN, of Berlin; Dr. A. HEDINGER, of Stuttgart; Dr. B. LUCAE, of Berlin; Dr. P. MICHAEL, of Paris; Dr. F. M. PIERCE, of Manchester; Prof. E. DE ROSSI, of Rome; Dr. G. SAPOLINI and Dr. E. SCHULTE, of Milan; Dr. JAS. A. SPALDING, of Portland, Me.; Prof. H. STEINBRÜGGE, of Giessen; Dr. H. TRUCKENBRODT, of Hamburg; Dr. O. WOLF, of Frankfort-on-the-Main; Prof. R. WREDEN, of St. Petersburg; and many others.

STANFORD MEDICAL
JUN 10 1936
LIBRARY

VOLUME XVIII.

NEW YORK

G. P. PUTNAM'S SONS, 27 & 29 WEST 23D STREET

LONDON: 27 KING WILLIAM STREET, STRAND

WIESBADEN: J. F. BERGMANN'S Verlag

PARIS: J. B. BAILLIERE, 19 Rue Hautefeuille

1889

CATALOGUED
JUN 19 1890
E. H. B.

COPYRIGHT BY
G. P. PUTNAM'S SONS
1889

Press of
G. P. Putnam's Sons
New York

CONTENTS OF VOLUME XVIII.

NUMBER I.

PAGE

1. Physiological Investigations of Nasal Respiration. By E. Bloch, of Freiburg (Baden). Translated by Drs. S. De Jager and F. Cohn, of New York. (Part II. With 7 wood-cuts) . . . 1

2. Report of Cases of Disease of the Mastoid Process, with Remarks. Part II. By Henry Ferrer, M.D., San Francisco, Cal. . . 25

3. Investigations upon Bacterial Invasion of the Labyrinth in the Course of Measles. By S. Moos, of Heidelberg. Translated by Dr. Max Toeplitz, New York. (With 11 lithographic illustrations upon plates i.–vi., and a colored plate, table vii., of volume xviii., German edition) 49

4. Reviews 101
   The Surgical Treatment of Brain Diseases. By Prof. E. Von Bergmann, Berlin.
   The Ear and its Diseases. By Samuel Sexton.
   A Manual of Diseases of the Ear. By Albert H. Buck.

5. Miscellaneous Notes 113

NUMBER 2.

1. Case of Purulent Meningitis in which Purulent Disease of the Middle Ear Invaded the Interior of the Cranium through the Labyrinthine Cavities and Fallopian Canal. By Dr. Jas. Finlayson and Dr. Thos. Barr, of Glasgow 115

2. Necrosis and Caries of the Temporal Bone Treated with Acids. By Dr. Ole Bull, of Christiania, Norway 123

3. Report of Cases of Disease of the Mastoid Process, with Remarks. Part III. By Henry Ferrer, M.D., San Francisco, Cal. . . 139

4. Report on the Progress of Otology during the Second Half of the Year 1888. Translated by Dr. Max Toeplitz, New York . . 183
   I.—Normal and Pathological Anatomy, Histology, and Physiology of the Ear and Naso-Pharyngeal Cavity. By A. Barth, Berlin.
   A.—Anatomy.
   B.—Physiology and Physics.
   II.—Pathology and Therapeutics. By A. Hartmann, Berlin.

5. Reviews 215
   The Technique of Dissecting the Normal and Pathological Human Ear. By Adam Politzer, M.D.
   Practical Guide to the Diagnosis and Treatment of the Diseases of the Nose. By Dr. G. Ferreri.

NUMBERS 3 AND 4.

		PAGE
1.	Case of Cerebellar Abscess, Due to Ear-Disease, Successfully Operated upon by Dr. Wm. Macewen, Glasgow. Reported by Dr. Thos. Barr	217
2.	Loss of Membrana Tympani, Malleus, Incus, and Stapes, with Good Hearing. By C. F. Clark, M.D., Columbus, Ohio . .	219
3.	Contribution to the Physiology of the Soft Palate. By Otto Joachim, New Orleans, La. Translated by Arnold H. Knapp, A.B. .	226
4.	Additional Botanical and Clinical Contributions to Otomycosis. By F. Siebenmann, Bâle. Translated by Dr. Max Toeplitz, New York. (With plate i. of vol. xix., German edition.) . . .	235
5.	A Rare Case of Auditory Reflexes. By H. Steinbrügge, Giessen. Translated by J. B. McMahon, New York	274
6.	Diseases of the Mastoid Process, with a Report of Cases. By Gorham Bacon, M.D., Aural Surgeon, N. Y. Eye and Ear Infirmary. (With four wood-cuts.)	280
7.	The Improvement in Hearing Obtained by the Action of Intense Sounds in Cases of Ceruminal Plugs. By W. Kosegarten, of Kiel. Translated by Dr. J. M. Mills, of New York . . .	308
8.	Investigations in Regard to the Influence of the Form of the Cranium upon Several Important Relations of the Temporal Bone. By Otto Körner, of Frankfurt-a.-M. Translated by Dr. J. M. Mills, of New York	310
9.	On Atresia Auris Congenita. By Dr. Eugene Jöel, of Görbersdorf, Silesia. Translated by Dr. Felix Cohn, New York . . .	317
10.	Miscellaneous Notes	325
11.	Index	327

At an external temperature of 17°, I found an increase in weight of the tubes after the last weight-determination of 0.0215; this increased quantity of aqueous vapor would saturate air at a temperature of 24°.[1]

In passing through the nose the air had not, therefore, been saturated to a degree corresponding with the increase in temperature; for a column of inspired air, with a temperature of 17°, is heated to 30°, in passing through the nasal cavity, as detailed above.

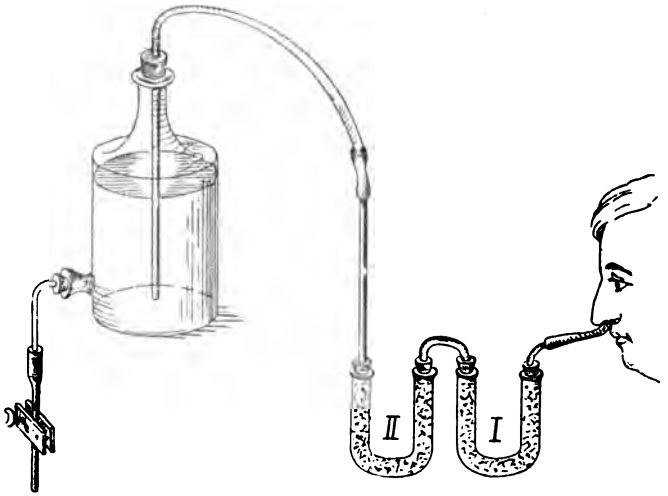


FIG. 5.

In another experiment, the external temperature was 16°; an increase of 20.8 grammes of aqueous vapor per cubic metre was found,—this weight corresponding to a saturation at a temperature of 23.4°.

In still another experiment, at an external temperature of 20°, 22.4 grammes, corresponding to saturation at a temperature of 25°. At one time a small portion of the expired air also entered the U-tube; an increase of 28.9 was recorded, corresponding to saturation at a temperature of 29°.

The last experiment demonstrated that this method of determination was not accurate. In the first place, it is

[1] Kohlrausch: "Leitfaden der prakt. Physik," 2te Auflage, Leipzig, 1872, S. 207.

difficult to obtain exactly one litre of air; besides, the velocity of the current of air is too great, especially at the beginning of the experiment, as is also the duration of each inspiration. Therefore I determined to change my method of experimenting and to employ a plan which would enable the experimenter to ignore the quantity of air aspired and the duration of the aspiration.

b.—Method of Determining the Dew-Point.

A solid which radiates heat in an atmosphere saturated with the vapor of water becomes covered with moisture as soon as its temperature falls below that of the surrounding atmosphere. If now this body be heated again, the moisture condensed on its surface disappears as soon as the temperature of the body rises above that of the surrounding medium. The temperature at which the vapor was condensed upon the body, or what is the same thing, the temperature at which the condensed moisture began evaporating from its surface, is called the *dew-point*.

Daniell's hygrometer, an instrument for determining the dew-point, consists of a glass tube terminating at each end in glass bulbs. One of the bulbs is partly filled with ether, and a thermometer inserted. A piece of cloth is wound around the other bulb, and in order to lower its temperature ether is poured over the cloth. The apparatus contains no air—only the vapor of ether. As the vapor of ether condenses in the bulb which is being continually cooled, the ether in the bulb containing the thermometer continues to evaporate; the temperature of the bulbs falls, and at a particular point the vapor of water in the surrounding air is condensed on the outer surface of the bulb containing the thermometer. The reading of the thermometer at this point gives the dew-point. The small apparatus (shown in fig. 6) has been constructed on this principle. A laryngeal mirror, 1.5 *cm* in diameter, is inserted into a small spindle-shaped glass tube; the mirror was introduced into the interior of the tube through an opening made near its middle, and then the tube was hermetically sealed; the mirror is placed obliquely to the axis

of the tube. A second tube is blown into the first, perpendicularly to the plane of the mirror, and its upper end closed by means of a cover-glass. Looking down this tube through the cover-glass, the eye of the observer will be reflected from the mirror. If moisture is condensed on the mirror-surface the image will of course be effaced. To the spindle-shaped tube a short rubber tube is attached leading to one nostril of the subject to be experimented on, while to the other end a longer rubber tube is attached leading to the mouth of the same subject. The apparatus is analogous to the one shown in fig. 3 for temperature determinations.

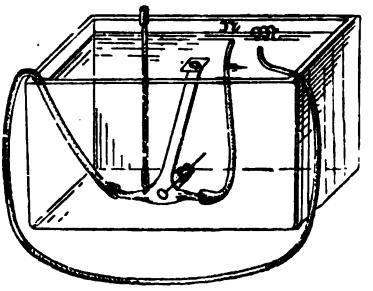


FIG. 6.

The apparatus is immersed in a water-bath, and then an inspiration taken through the tubes. The tubes very soon assume the temperature of the surrounding water, and as soon as this temperature becomes lower than the temperature corresponding to the saturation of the air, the mirror becomes covered with moisture, and the dew-point is determined. Even a small quantity of air suffices; respiration may go on normally during the experiment. The tubes were immersed in a water-bath at 26.5°; the temperature of the external air 15°.

A.—The experiment was begun at 11.15.

At 11.37,	temperature	of	bath 26.4°,	no condensation	on mirror.
" 11.40,	"	"	26.2°	"	"
" 11.42,	"	"	26.0°	"	"
" 11.45,	"	"	25.7°	"	"

At 11.52, temperature of bath 25.2° no condensation on mirror.
" 11.59, " " 24.4° " "
" 12.06, " " 24.1°, condensation on mirror.
" 12.15, " " 24.2° " "

Dew-point, therefore, lies between 24.4° and 24.2°—say, at 24.3°.

B.—External temperature of 13.5°; apparatus immersed at 4.15; temperature of water-bath 26°.

At 4.24, temperature of bath 25.4°. no condensation on mirror.
" 4.30, " " 24.5°. trace of moisture on mirror.

Apparatus dried; and again placed in the water-bath at 4.53; temperature of the water being the same as at 4.30, *i. e.*, 24.5°.

At 4.58, temperature of bath 24.4°, no condensation on mirror.
" 5.01, " " 24.1°, condensation on mirror.
" 5.06, " " 24.2° " "

Dew-point, therefore, 24.3°.

The same result was obtained with an external temperature of 12.5°.

The conclusion which we must arrive at, is that the evaporation of water from the nasal mucous membranes is independent (within limits) of the temperature of the external air.

If the air had been completely saturated while passing through the nose, the dew-point would have been 29°; for, as has been shown, an atmosphere of 23°, after passing through both nares, is heated up to 29°.

But at 29° the vapor-density of the air is . 28.63;
at 24° only . . . . . 21.59.

The air therefore has taken up only ¾ as much moisture as it would have absorbed had it been saturated for its temperature.

This method of determining the vapor-density is open to the same objections that were made to thermometric determinations. All we can assume, in view of the results that have been obtained, is, that the air in passing through the nose absorbs moisture in some direct proportion to the

resulting rise in temperature. If we determine the thermometric action in the nasal cavity of one side according to the formula

$$E = \tfrac{5}{9}(37 - t)$$

we may calculate the amount of water absorbed according to the same formula; we can also assume that $\frac{1}{6}$ less of the vapor of water is absorbed by the air in passing through one nasal cavity than there would be in passing through both. Instead of the fraction $\frac{75}{100}$, we obtain therefore for the vapor-density of the inspired air, after passing through the nasal cavity of one side, the smaller fraction

$$\tfrac{63}{100}\ (\tfrac{5}{6}\ \text{of}\ \tfrac{75}{100}).$$

Therefore the air, at an average temperature, would pass into the pharyngeal cavity through the nose only $\frac{3}{5}$ saturated.

IV.

RETENTION OF DUST-LIKE IMPURITIES IN THE INSPIRED AIR BY THE NOSE.

How small particles of dust contained in the air are retained in the nose has, to my knowledge, not yet been examined. Is it due to the viscid condition of the mucous membranes, or is it to be attributed to the weight, or the hygroscopic condition, or perhaps the solubility of the solid particles? Is it, moreover, true that all particles of dust, provided they are coarse enough, are retained in the nose? This view is held by Aschenbrandt.

It seemed desirable to investigate this interesting question, to ascertain whether or not particles of dust are retained in the nose during the act of inspiration, and, if retained, to what extent.

For these experiments I used the following substances: Wheat flour, potato flour, powdered cloves, lycopodium, chloride of ammonium, boracic acid, kino, shellac, magnesia, gypsum, chalk, charcoal, anthracite coal, burnt umber, sienna, sap-earth, etc.

First I examined specimens of these powders under the microscope (with a linear enlargement of 138), and then

took 1 *cc* or 10 *cc* of each powder, weighed it, and observed also how each substance reacted on warm and cold water.

The experiments were conducted in the following manner (see fig. 7):

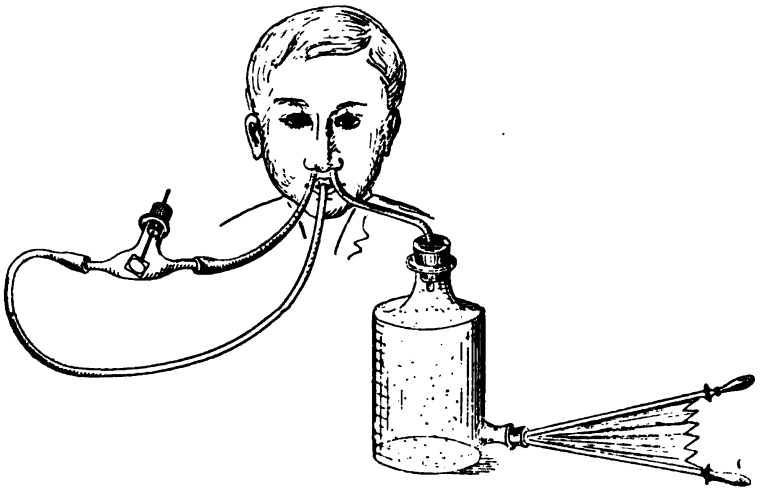


FIG. 7.

The powder was placed into a large bottle provided with a rubber stopper, and was stirred up by means of bellows. Through the stopper a glass tube was inserted, connecting with a rubber tube, which terminated in a glass nose-piece for the right [1] nostril. The apparatus which had been used to determine the dew-point was connected through a similar arrangement with the left nostril. The mirror was inserted less obliquely than in the apparatus before described, and was covered by a cover-glass whose upper surface was moistened with glycerin; the distal end of the apparatus passed, as in the other experiment, into the mouth of the subject.

The inspired air first passed through the bottle, then through the nose, from right to left,[2] then past the cover-glass in the apparatus, and finally into the mouth and lungs. Each experiment was limited to one inspiration, and at its

[1] In the drawing the nose-piece is inserted into left nostril.
[2] In the figure from left to right.

conclusion the cover-glass, as well as the mucus blown from the nose, was examined under the microscope.

1. *Wheat Flour.*

The right nasal cavity, *i. e.*, the cavity through which the air passed first, is found to contain starch, the presence of which is determined by the iodine test; the secretion from the pharynx gives the same reaction. The left nasal cavity contains but very few granules; on the cover-glass, *no trace of amylum visible.* This experiment was repeated several times, and with uniform results. One *cc* of the flour weighs 0.76 gramme. Starch granules are very hygroscopic; swell up in water.

2. *Potato Flour.*

Potato-starch granules are four to eight times as large as those of wheat; their size, however, varies considerably. They swell in water somewhat more than do wheat granules. One *cc* weighs 0.91 gramme. This is one of the heaviest of all the powders employed. The secretion from the right nares was found to be very rich in amylum cells; the pharyngeal secretion contained rather small granules. No amylum corpuscles in the left nasal cavity; none on the cover-glass.

3. *Lycopodium.*

Round, dark-yellow granules of uneven surface, of nearly uniform size (four times the size of wheat granules). One *cc* weighs 0.42 gramme; lycopodium is absolutely non-hygroscopic. The right nasal cavity, as well as the pharynx, contained a few granules; left contained many. The cover-glass also showed several grains of dark and light colors.

4. *Powdered Cloves.*

Very dark granules, fragmentary, and in groups; the single cells are not always recognizable as such; powder not very hygroscopic; one *cc* weighs 0.60 gramme. The strong scent of cloves appreciable only in the right nasal cavity, and a large quantity of powder found on this side; only traces, however, in the pharynx and the left nasal cavity. On the cover-glass were found several small grains.

5. *Dragon's Blood.*

A resin, obtained from Dracæna draco, of reddish-brown color; is not changed by glycerin; under the microscope the resin appears to consist in part of regular small granules, and in part of large amorphous masses; one *cc* weighs 0.46 gramme; it is not hygroscopic; floats in water, and is insoluble. In the secretion from the right nares were found large quantities of the granules, but only of the smallest size; the same in the left; the cover-glass retained large quantities of the resin, but only smaller granules.

6. *Shellac.*

Light, amber-colored, coarse, amorphous granules, with sharp edges, as large on the average as the larger potato granules; one *cc* weighs 0.69 gramme; not hygroscopic; insoluble; floats partly on water. In the right nasal cavity many large and small particles were retained; on the cover-glass were found several small and large granules about the size of the potato-starch granules.

7. *Kino.*

Yellowish-brown, amorphous masses; otherwise very similar to the resin; soluble in glycerin; soluble in water; when inhaled gives rise to a peculiar odor, and a fæcal taste in the mouth; one *cc* weighs 0.68 gramme. Upon inspiration many granules were found in the right side of the nose, though not of the very largest size; in the left nasal cavity, several smaller ones; on the cover-glass, many of the smaller granules.

8. *Magnesic Carbonate.*

Each of the crystals is about three times as long as the large potato granules. One *cc* weighs 0.14 gramme. The powder sinks rapidly in water. Experiment produces a sensation as if the nose and pharynx had been filled with dust. A large quantity of the light powder is retained in the right nasal cavity. Nevertheless, we find many very small granules on the cover-glass.

9. *Gypsum.*

This powder is composed of rhombic tablets, and also of small particles of irregular shape. One *cc* weighs 0.93 gramme; very hygroscopic; produces the sensation of dust already described. In the mucus from the right side, a few large particles and much detritus are found; on the left, only small particles; the same on the cover-glass.

10. *Chalk.*

Settles rapidly in water; moderately hygroscopic. One *cc* weighs 0.70 gramme. On the cover-glass but few small particles are visible under the microscope; but on the addition of HCl a large number of separate bubbles appear.

11. *Burnt Umber.*

Pyrosiderite, containing clay, probably adulterated with peat. Under the microscope small dots and amorphous masses of a dark-brownish or yellowish hue are visible; very hygroscopic; one *cc* weighs 0.61 gramme; insoluble in cold water. The inhalation of this powder produces a disagreeable irritation in the throat and excites coughing. The mucus from the right as well as from the left nares is very much colored; on the cover-glass many of the smallest particles.

12. *Sienna.*

Round yellow granules, about the size of wheat starch; is composed of clay, ferric hydrate, and manganese; one *cc* weighs 0.84 gramme; very hygroscopic. The inhalation produces a sensation of dust in the throat. On the right side, but few heaps and many single particles; the same on the left; on the cover-glass, numerous of the smallest granules.

13. *Sap-Earth.*

This powder is composed of silica, iron, and magnesia; under the microscope, amorphous masses of olive-green color. One *cc* weighs 0.60 gramme. Very hygroscopic; gives a muddy filtrate. Upon respiration, an earthy taste on the tongue. The right side contains very many particles; somewhat less on the left; only a few of the small particles on the cover-glass.

14. *Charcoal.*

Appears under the microscope as small, irregular, amorphous granules; one *cc* weighs 0.51 gramme. The sensation of dust is produced in the nose and throat. After inspiration, several coarser granules on the right side; smaller on the left; on the cover-glass an innumerable quantity of the smallest-sized pieces, as well as a few larger particles.

15. *Anthracite Coal.*

Finely powdered anthracite coal was used; the granules are somewhat sharper on the edges than those of charcoal. One *cc* weighs 0.74 gramme. Somewhat hygroscopic; settles very rapidly in water. On inspiration, a sensation of dust in nose and throat. In the right and left nasal cavities, many small granules and also several larger ones.

16. *Salicylic Acid.*

Produces the well-known irritation in the throat when inhaled through the nose. Passes through the nose easily in spite of the fact that single crystals are rather large.

17. *Boracic Acid.*

Acts similarly. The same sensation in the nose; irritation in the throat not quite as great as with salicylic acid.

18. *Chloride of Ammonium* (*Vapor*).

May be readily driven through the nose either from the anterior or posterior nares; was generated with the apparatus used by Dr. Thiry in the Aural Policlinik. The apparatus consisted of three bottles connected together by short glass and rubber tubes. One bottle contained HCl; the other, ammonia; and the third, water.

Air is forced through the bottle containing HCl by means of a pair of rubber bulbs. The HCl gas is thus forced into the bottle containing ammonia; the spray of chloride of ammonium thus formed passes through the water contained in the third bottle, and is there freed from the excess of acid. From the last bottle it passes out in dense vapors.

If the vapor be pumped into one nasal cavity, it passes

out of the mouth a little less dense than when it entered; and in the same way it can be forced out of the nares when passed through the mouth. The same occurs with tobacco-smoke; a certain quantity is always retained by the nose; even in the buccal cavity the smoke precipitates in considerable quantities.

We see, therefore, *that of all the powders examined, the greater part was retained in the nose, but that, nevertheless, a certain quantity of all of them passed out*, amylum being the only exception in that it was wholly retained in the nose.

But if dust particles can pass the nares, we can assume with absolute certainty that they also enter the respiratory organs. During ordinary respiration, therefore, dust will pass through the larynx into the lungs, although a small fractional part will also be retained by the mucous membrane of the pharynx. Although the velocity of the current of air in passing from the narrow nasal passages into the wider pharyngeal space is diminished, it is improbable that all the particles can come in contact with the walls of the pharynx.

The powders used in the experiment showed considerable differences in their physical properties; the weight varied from 0.14 gramme (magnesia) to 0.93 gramme (gypsum) per *cc.*

It is quite evident that the fact of starch being wholly retained was not due to its specific gravity; nor does the condition of the surface of the particles afford us any explanation therefor. Amorphous, crystalline, pointed, rough, or smooth particles, all passed through the nose; starch was even the smoothest of all.

Nor can we explain this phenomenon on the ground of the differences in the size of the particles, although it is true, in a general way, that the smallest granules pass through the nose most readily. Nor does the hygroscopic condition of the substances used afford us an explanation, although it is true that shellac, dragon's-blood, lycopodium, etc., substances which are least hygroscopic, passed through the nose in great quantities. Still charcoal, which is very hygroscopic, also passed through very readily.

Nor is it true that the more hygroscopic bodies are retained by the nose when they have once come in contact with its mucous membrane.

A simple experiment proves the contrary: powdered amylum and dragon's-blood were well mixed, and some of the powder was strewed over a piece of moistened paper; the back of the paper was then flapped with the finger several times, and a part of the powder naturally shaken off. The paper was then examined under the microscope. Both granules of dragon's-blood and amylum granules were visible. If lycopodium be used instead of dragon's-blood, even more lycopodium than starch granules are retained.

The reason that starch is retained more than other substances is probably its *relatively high specific gravity, together with its enormous capacity for the absorption of water.* Its weight is probably so much increased by the water which it absorbs, that all or very nearly all the granules precipitate during their passage through the nose.

On the whole, therefore, we may assume it to be true in a general way, that the amount retained will depend somewhat on the weight, the hygroscopic property, and the size of the particles.

We come to the conclusion **that small solid particles are retained by the nose to a great part, but that the nose is not capable of freeing the inspired air entirely from impurities, not even with the aid of the naso-pharyngeal cavity.**

V.

THE EFFECT OF NASAL RESPIRATION ON THE BUCCAL CAVITY.

The preceding remarks have clearly shown the advantages of nasal respiration. A current of air inhaled through the mouth causes too rapid a loss of moisture in the buccal and pharyngeal cavities, since their mucous membranes are not provided with the natural apparatus for replacing the water lost by evaporation.

The cavities also lose heat too rapidly, and their mucous

membranes have not the mechanism provided to replace this loss. The teeth must also suffer in this unnatural form of respiration, and in this way even further disturbances, such as impairment of smell, taste, etc., are possible.

I believe also that nasal respiration is not without influence on the interchange of gases in the lungs. We need not dwell any further upon the fact that the larynx, the bronchi, and the lungs are provided with no other filter against solid impurities in the air than the nasal cavities.

I propose here to discuss the effects of nasal respiration upon the buccal cavities. Mezger[1] has called attention to the fact that, in breathing through the mouth, a special muscular effort is required, though the mouth can be kept closed for hours without any such expenditure of muscular energy. During nasal respiration, the tongue, by pressing tightly with its upper surface upon the vault of the palate, shuts off the communication between the buccal and pharyngeal cavities. The margins of the tongue and a part of its lower surface meanwhile rest on the lower jaw. The weight of the tongue and the lower jaw are supported by the pressure of the external air alone, during nasal respiration, no muscular effort being required for this purpose.

Donders[2] agrees with this view, and adds, that if we measure the pressure of the air in the mouth manometrically during nasal respiration, we find no fluctuations recorded as long as the mouth-piece remains in the buccal cavity; but if the mouth-piece, which had been attached to the manometer by a long rubber tube, is placed away back into the pharynx, the fluctuations ordinarily obtained on connecting the manometer with the nose, for instance, are immediately recorded. This experiment affords another proof that the buccal cavity is shut off from the pharynx during nasal respiration. According to Donders, the contracted soft palate acts as an obturator between the two cavities. According to the same author, the mouth is kept in position

[1] Über den Luftdruck als mechanisches Mittel zur Fixation des Unterkiefers gegen den Oberkiefer im ruhendem Zustande. Von Dr. Joh. Mezger, Amsterdam. Pflüger's *Archiv f. d. gesammte Physiologie*, Bd. x., Bonn, 1875, S. 89.

[2] "Über den Mechanismus des Saugens," von F. C. Donders, *l. c.*, 91.

during sleep, for instance, chiefly by the action of the hyoglossus muscle.

Henke[1] expressed a similar view years ago. During ordinary respiration, according to this author, the soft palate rests on the back and base of the tongue, the elongated uvula in the groove on the posterior surface of the epiglottis, while the lingual surface of the latter is in apposition with the base of the tongue, so that a direct and open passage is formed from the posterior nares to the larynx. "The current of air during ordinary respiration, therefore, does not come in contact with the buccal cavity. According to Henke, the anterior portion of the tongue is held in position by muscular action.

The following experiment proves clearly that during nasal respiration, the buccal cavity is hermetically shut off from the pharyngeal. The mouth is filled with tobacco-smoke to such an extent that the cheeks are puffed out; if the cheeks are now compressed, the lips being closed, no smoke enters the nose or the larynx; the lips may even be tightly pressed against the incisors, and the cheeks drawn in, as in sucking, and still no smoke passes beyond the buccal cavity. In order to compensate for the diminution of space in the anterior portion of the buccal cavity, the back of the tongue probably separates from the hard and the soft palate. Posteriorly the buccal cavity, during this time, is probably separated from the pharynx by the border of the palatal arch and the uvula alone; certainly not by more than a very small portion of the soft palate.

Although I have not been successful in my attempts at repeating the experiment of Donders, in measuring the pressure in the buccal cavity throughout its whole extent, I have partially succeeded in determining the pressure when the mouth-piece attached to the manometer was placed close to the hard palate; not a trace of change in the pressure was recorded. Of course, I took care that the lumen of the rubber tubing

[1] Ph. J. W. Henke: "Beiträge zur Anatomie des Menschen mit Beziehung auf Bewegung." Leipzig und Heidelberg, 1872, Erstes Heft, Anhang, "Versuche in Bildern zur Topographie der Bewegungen," Tafel ix., Bewegung des Schlundkopfes, Fig. 3; Stellung beim Athmen. S. 42.

was not obliterated by pressing it too tightly with the teeth. If the mouth is then opened, or the manometer connected with the nasal cavity, the changes in pressure during respiration become at once apparent. In those cases in which the epiglottis has a horizontal position—as is sometimes found during a laryngoscopic examination,—it is impossible that the uvula should fit into the saddle-like groove on its posterior surface, as Henke believes. I cannot agree with this view of Henke's, for I cannot imagine that in ordinary respiration the epiglottis should be in the position which we find it in during a laryngoscopic examination. Such positions are, in my estimation, artificial. But as the position of the epiglottis does not play a very important rôle in the physiology of the buccal cavity, I do not deem it necessary to object entirely to Henke's view as Störk[1] has done. The position which Henke assigns to the anterior border of the tongue is also, in my opinion, not quite correct. During nasal respiration, the tip of the tongue generally rests between the teeth in apposition with the mucous membrane of the lips or the cheeks. This can be proved by careful self-observation. At times, but by no means constantly, are the teeth kept closed. Nor do I believe that the mouth is closed at the beginning of nasal respiration by the action of the lingual muscles. When the mouth is closed, the palate and the tongue are still separated by a certain quantity of air. This residual air communicates through the nose with the external atmosphere, and is therefore of the same pressure. This air is aspired at the first inspiration that follows the closing of the mouth. As the pressure in the buccal cavity is now zero, or at any rate has become less than normal, the positive pressure on the pharyngo-nasal surface of the soft palate brings the soft palate in apposition with the posterior surface of the tongue. In the meanwhile, the anterior portion of the tongue is pressed upon to the upper maxillary and hard palate by the positive pressure of the air under the chin.

[1] C. Störk: Klinik der Krankheiten des Kehlkopfes. Stuttgart, 1880. Erklärung zu Tafel iii., in front of page 185.

Nasal respiration thus saves an amount of work which would otherwise require the expenditure of muscular energy.

The pernicious effects of mouth-breathing may be seen in the children who suffer from adenoid vegetations. The tired, sleepy, and usually stupid expression of countenance of such children furnishes an apt illustration of its bad effects.

VI.

THE RESPIRATORY REFLEXES EXCITED BY THE NASAL MUCOUS MEMBRANE.

In 1870 Kratschmer,[1] of Vienna, discovered that when a volatile fluid—chloroform, ether, alcohol, ammonia; acetic, hydrochloric, and nitric acids, etc., or tobacco-smoke—is placed in front of a rabbit, the animal immediately makes a strong expiratory movement and closes the nostrils. The same thing happens if the outer surface of the nose is irritated mechanically by tickling, pinching, or cooling, as with a piece of snow. This reflex-expiration occurs even if the stimulus be applied at the beginning of an inspiration. In addition to this expiratory movement and the closure of the nostrils, respiration ceases, the vocal cords are approximated, and the glottis closes until the beginning of the following inspiration. At the same time the heart ceases to beat, and its function is only gradually restored, so that it does not attain its normal rate until some time after respiration is again normal. Respiration sometimes was observed to cease for one or two minutes, complete arrest of respiration lasted as long as fifty-three seconds, the average arrest being twenty seconds. Furthermore, the blood-pressure was considerably increased for a time after the application of the stimulus.

Kratschmer also showed that irritation of the larynx or of the trachea did not give rise to these reflex phenomena, but that the results were only obtained upon irritation of the mucous membrane of the nose.

---

[1] F. Kratschmer: "Über Reflexe von der Nasenschleimhaut auf Athmung und Kreislauf." Sitzungsber. d. Akademie der Wissenschaften, math.-naturw. Classe, Bd. lxii., 2. Abth., Wien, 1870, S., 147 *ff.*

If the vagi are cut, there is no effect produced on the heart. Respiration and the blood-pressure are affected, however, in the manner described. If the trigeminus be cut, however, the reflexes before produced do not occur; the course therefore must be through this nerve. The olfactory nerve has no influence. In order to produce a closure of the glottis in rabbits, it is only necessary to introduce a probe in the nose; after cutting the vagi, this reflex is prevented.

Kratschmer considers this reflex to be a natural safeguard against the aspiration of substances that might irritate the respiratory organs. Respiration ceases in order to prevent the aspiration of these, and the strong expiration that immediately follows expels what may already have been inspired.

According to Kratschmer, therefore, "there must be a peculiar reflex connection between the nasal mucous membrane on the one hand and the respiratory and circulatory organs on the other." The sensory fibres of this connection lie in the trigeminus; the motor, in the nerves which supply the muscles engaged in respiration; other motor fibres for the heart, in the vagus. The reflex occurs whenever that portion of the nasal mucous membrane is irritated, whose nerve supply is derived from the trigeminus. It effects an expiratory tetanus with a simultaneous closure of the glottis, slowing of the heart-rate, and increase of blood-pressure in the arteries.

These important observations have been confirmed in a recent publication by Sandmann.[1] Sandmann, however, found that stimuli of less intensity do not always necessarily produce an expiratory tetanus, but simply cause an arrest of respiration in its particular phase at the moment of irritation.

Sneezing is the reflex that results on tickling the mucous membrane of the nose. The reflex is as follows: a deep inspiration, upon which the naso-pharyngeal space is shut

[1] G. Sandmann: "Über Athemreflexe von der Nasenschleimhaut." Verhandlungen der physiolog. Gesellschaft zu Berlin, Jahrgang 1886–87, No. 18, vom 15ten August, 1887.

off from the nose by the soft palate, the buccal cavity by the tongue; a strong expiration follows, during which the pharynx is again opened, while the air under strong pressure escapes through the nose.

The nasal cough cannot be produced in rabbits and cats. In these animals the region of irritability is confined chiefly to the anterior portion of the inferior turbinated bones and the parts of the septum adjoining them. In the human being, the sensitive zone is confined to the anterior portion of the inferior and middle turbinated, the portions of the septum adjoining, and corresponding portions of the posterior turbinated. The anterior zone is supplied by the ethmoidal nerve, a branch of the naso-ciliary—of the first branch; the posterior by the pterygo-palatine nerve—a branch of the second.

The reflexes that follow irritation of these parts are, depending upon the nature or the intensity of the stimulus: slowing of respiration, arrest in some phase of respiration, arrest in expiration.

On attempting to study these observations on the human subject, we find that the reflex produced by tickling is exactly the same as the one found by Kratschmer and Sandmann in animals. Common observation shows us that strong irritations produce inhibitory reflexes in the human subject also. Inhalation of pungent vapors, of dense smoke, a cold and sudden draught, dense dust, takes one's breath away, *i. e.*, arrests respiration. The same phenomenon is also observed during mechanical irritation, especially during operations that are performed in the nose —galvano-caustic operations, for instance. If the individual is very sensitive, the mere introduction of the speculum produces the reflex. I have very often observed the occurrence of a quick expiration, apparently produced by reflex action, upon the application of the galvano-cautery. Immediately upon cauterization, the smoke produced is expelled by a sudden expiration; if the parts are first anæsthetized with cocaine, the reflex does not occur.

Experimentally, I have succeeded in obtaining this inhibitory reflex only during inspiration (and during any

phase thereof), but not during expiration; for very strong irritations would be required to produce this reflex during expiration, too strong for experiments on human subjects.

A cylindrical tube, 3 *cm* in diameter and 8 *cm* in height, is curved into the shape of a segment of a circle of very large radius. A short tube, 4 *mm* in diameter, inserted into the middle of the convex side, serves to connect the cylinder with a Marey's tambour-à-levier. The ends of the

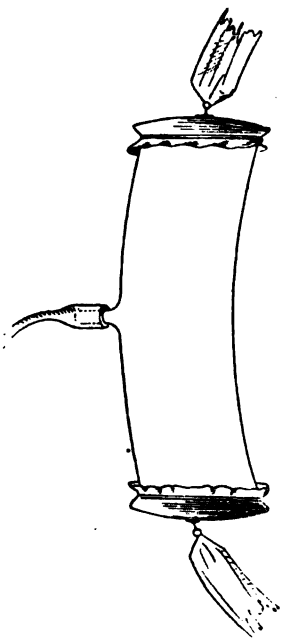


FIG. 8.

bent tube are hermetically sealed with fine rubber-membranes provided with metallic rings for the attachment of elastic bands. This apparatus was fixed to the thorax, on a level with the lower end of the sternum, by means of the elastic bands. The index of the tambour records the respiratory movements of the thorax upon a drum, which is set in motion by clock-mechanism, the movements of the thorax being communicated to the index through the expansion and contraction of the elastic bands and the air

contained in the cylindrical tube. At every inspiration the elastic belt pulls the rubber membranes outward, the area of the cylinder is enlarged, the air accordingly rarefied, and the index falls. At every expiration the opposite takes place, and the lever-index is raised (fig. 8).

If, now, during nasal respiration, a pungent vapor like ammonia be inhaled, the index records a horizontal line: respiration has come to a standstill. This cessation of respiration may occur at the beginning, during, or at the end of an inspiration, depending on the phase of the inspiration at which the stimulus was applied in the nasal cavity.

If the nostrils are closed, and the vapor is inhaled through the mouth, this inhibitory reflex does not occur.

If ammonia is sprayed into the nose during expiration, the arrest of respiration is not recorded before the ensuing inspiration begins. Immediately after the application, I felt a burning sensation in the floor of the nasal cavity; but the expiratory current of air probably prevented the gases from coming into too close contact with the sensitive zones. This zone was, however, irritated upon the ensuing inspiration.

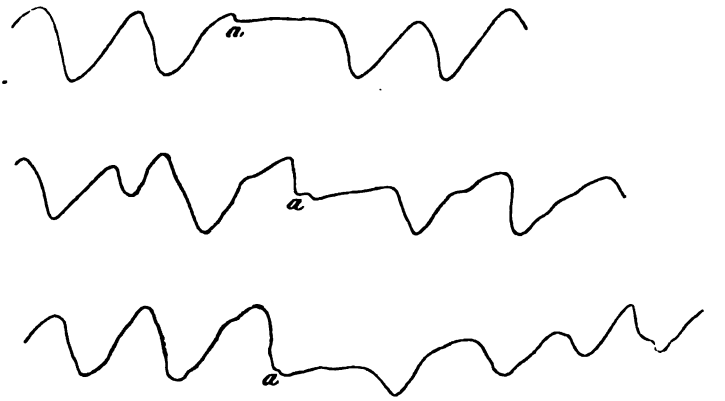
Tobacco-smoke in greater quantities has a similar effect; as also has acetic acid, chloroform, etc. The duration of the inhibitory action is, within limits, proportional to the quantity of the vapor inhaled, *i. e.*, proportional to the intensity of the stimulus.

Attempts to influence respiration by means of faradic stimulation of the nasal mucous membrane yielded no positive results. A wad of moistened tissue-paper, around which the ends of a conductor had been wound, was shoved into one nostril between the septum and the inferior turbinated bone, while the other electrode was held in the hand. Although the current was increased to such an extent as to become positively painful, the curve recorded by the tambour-lever was not altered in the least.

The respiratory standstill was invariably followed by an inspiration, even though the arrest took place at the end of the previous inspiration.

The curves shown in Figs. 9, 10, and 11 illustrate the results obtained :

Stimulus, ammonia. Inhibitory reflex begins at *a*.



FIGS. 9, 10, 11.

As already stated, spasm of the glottis, in all probability, generally accompanies the pause in respiration,—to judge from the muffled tone of the voice. Whether this spasm is due to the fact that expiration becomes more difficult, or whether the arrest of the inspiration may not be due in part to the ensuing spasm, we must leave to further investigation. I have, however, satisfied myself by direct observation, that during oral inspiration a large quantity of ammonia may be inhaled, without any effect on the glottis whatsoever. In oral inhalation, moreover, respiration does not cease ; the record shows simply a slight retardation and a diminished intensity of the respiratory movement. This retardation however may be due to some psychical influence. The experiment proves positively that a spasm of the glottis is dependent solely on the irritation of the nasal mucous membrane.

If the nasal mucous membrane be but slightly irritated, as, for instance, with the probe, and the larynx examined at the same instant, we find that there is no approximation of the vocal cords toward the middle line. It is impossible to study the effects produced in the larynx when very strong

stimuli are applied, because a reflex contraction of the pharyngeal muscles accompanies the (probably) ensuing spasm of the glottis, and precludes the possibility of obtaining a laryngeal image.

This much, however, is certain: *that in the human subject a strong mechanical, thermic, or chemical stimulus applied to the nasal mucous membrane during inspiration produces cessation of respiration in whatever position the thorax may happen to be at the moment the stimulus is applied.*

I have not been able to determine whether or not the influence exercised on the action of the heart by stimulation of the nasal mucous membrane is the same in the human subject as in the animals upon which the experiments have been made. I have observed, in some cases, a retardation of the pulse after the application of the galvanocautery; in others, again, this retardation did not ensue. The late Prof. Hack also called attention to this phenomenon. We cannot, however, assert positively that in these cases the heart has been acted on merely by painful irritation of the trigeminus, as we know that irritation of almost any sensory nerve produces a similar effect on the heart's action.[1]

My experiments, made especially with a view to determining these reflex effects on the heart-action, were without positive results. Stimuli which brought respiration to a standstill had no marked effect on the recorded pulse-curves; my experiments in this direction, however, were brought to an untimely end by the vertigo, irregular heart-action, etc., which ensued.

I believe the experiments on the physiology of nasal respiration to warrant the following conclusions:

1. *The temperature of the inspired air is considerably raised while passing through the nasal cavities.*

2. *The thermogenic action of the nasal mucous membrane is greater when the temperature of the external air is lower.*

[1] See Francois-Franck: Effets des excitations des nerfs sensibles sur le cœur, etc. Physiologie Expérimentale, Travaux du Laboratoire de Marey, II. Année, 1876; Paris, 1876, S. 221 *ff.*; also Recherches sur le méchanism des accidents cardiaques causés par les impressions douloureuses (*Gaz. hébdom*, 1876; cit. *Schmid's Jahrb.*, 1878, Bd., clxxvii).

3. *The thermogenic effect of the nasal mucous membrane is constant, depending on the relation of the external temperature to the temperature of the body.*

4. *Under normal conditions this relation is expressed by the formula* $E = \frac{5}{9}(37 - t)$.

5. *The temperature of the expired air is* 1.5°–2° *C. higher after nasal respiration.*

6. *The thermogenic action of the buccal cavity is slight as compared to that of the nasal.*

7. *The heat given up by the nasal mucous membrane at each ordinary inspiration, and at a moderate external temperature, is equivalent to* 6 *gramme-calorics.*

8. *Inspired air passes out of the nose about* $\frac{3}{4}$ *saturated.*

9. *The nasal mucous membrane retains the greater part of the solid particles which may be contained in the inspired air.*

10. *It does not, however, act as a perfect filter for dust.*

11. *The amount of dust retained depends principally upon the normal viscidity of the nasal mucosa; also on the weight, size, and hygroscopic condition of the solid particles inhaled.*

12. *During nasal respiration, the tongue is pressed against the palate, and the mouth closed anteriorily and posteriorily, solely by the pressure of the external air.*

13. *Every considerable mechanical, chemical, or thermic stimulus, acting upon the nasal mucous membrane through the inspiratory air-current, induces an immediate cessation of the respiratory act.*

14. *This respiratory standstill is immediately succeeded by an inspiration.*

15. *It is probable that weak stimuli only retard inspiration; and it is possible that very strong stimuli induce an immediate expiratory movement.*

REPORT OF CASES OF DISEASE OF THE MASTOID PROCESS, WITH REMARKS.[1]

By HENRY FERRER, M.D., San Francisco, Cal.

Case 11.—**Chronic Otorrhœa, left side, with Caries of Mastoid Extending to Occipital Bone; Chiselling of Mastoid; Phthisis Pulmonum; Death.**

Mr. N——, about 35 yeara old. I saw him first the 3d of May, 1886, in consultation with Dr. Barkan, who had been treating him a couple of weeks for otorrhœa of left side. He complained of severe pain in the ear, forehead, and occipital region, the discharge was very profuse, there was slight swelling of walls of meatus, no swelling of mastoid, but sensitiveness upon pressure. He kept his bed, had fever and night-sweats, cough and mucopurulent expectoration. The doctor kindly advised him to go to the German Hospital and place himself under my care. The following day he was admitted, and treated with inflations of middle ear either with Politzer's method or catheter, syringing of meatus a couple of times daily with a 1 % solution of carbolic acid; the temporal and mastoid regions were shaved, and a strong tincture of iodine and an ice-bag applied. This treatment was continued until the 17th; in the meantime we had found that both lungs were extensively infiltrated at apices, and tubercle bacilli found in sputum. Several attempts to find the bacillus in the pus from meatus failed. The night-sweats were profuse, for which we gave him large doses of morphia. The ice relieved him, but now there was wellmarked swelling of mastoid; the pain had become excruciating and we decided to operate.

Operation: Dr. Barkan and Dr. J. Morse assisting. Incision of external integuments as usual, and about 5 to 6 *ctm* long. Peri-

[1] Continued from p. 326, vol. XVII.

osteum was attached to the bone, the surface of which was slightly discolored. Integuments about 0.1 thick, infiltrated; moderate hemorrhage. *Spina supra meatum* and emissary vessels not well defined. I began to chisel as usual with the largest chisel, and at the depth of 2 to 3 *mm* pus was found; after enlarging the external opening the scoqp was mostly used, the trabeculæ and even the external plate felt spongy. The quantity of pus found was much smaller than expected. I penetrated over 2½ *ctm*, and in trying forced injections no communication had been obtained. The same night patient had considerable pain and more or less discomfort until June 5th. The discharge from meatus had decreased; the granulating process was so rapid and the granulations so pale that on 5th of June I decided to scoop them out again and to introduce a nail. The reason that no nail had been used before was the continual complaint of pain, which was only relieved by the constant use of ice and large doses of McMunn's elixir of opium. I need not state that he had been attended once and even twice daily, and that severe cauterization of the granulations had also been resorted to.

In this second operation only the scoop was used, and an effort made to obtain communication; the depth reached was 3 *ctm*. In very few days granulations began to shoot up, and a conical lead nail was applied. Patient still complained of pain, especially in left occipital region. This part became very sensitive to pressure, and an abscess formed about 5 *ctm* backwards and 3 below the original opening in the mastoid. On the 26th of July he was placed again under ether, the abscess opened, discharging a tablespoonful of pus; the original opening in mastoid was scooped out again. We then discovered that most of the mastoid appendix had been removed; the softening of the bone extended into the occiput and materially affected even its surface. The bone was spongy and filled with granulations. A thick drain-tube was carried through from the opening in the occiput to that in the mastoid and was thoroughly cleansed. Communication with middle ear had been established and the discharge decreased very much. During the month of August he recovered materially, was able to be up most of the time and to walk in the hospital grounds. He left on the 17th. Afterwards he was attended to in my office as an out-door patient until September 18th. The drain was removed; the canal connecting occipital abscess and mastoid had closed perfectly; there was very little discharge from

the meatus and mastoid. Here a smooth canal existed of the exact shape of the nail. He had learned how to attend to his own case, using a Davidson syringe with a short point to cleanse the meatus as well as the fistula in mastoid. His general health, though somewhat improved since the last operation, was much worse than when I first saw him. He was fortunately able to take, besides three good meals daily, three and four tumblers of an emulsion of cod-liver oil and malt with whiskey; he had even reduced and often done without morphine at night. His cough had somewhat decreased, the expectoration was not profuse, and in this condition he left, somewhat hopeful, for the mountains.

February 5th I received a letter from Dr. Rooney, in Auburn, Cal., stating that he had been attending to Mr. N——, who was taken with paralysis of the tongue and muscles of deglutition, produced by post-pharyngeal induration, which he incised, liberating a large quantity of pus. In syringing the abscess with carbolized water, communication existed with the external meatus. The injections were used daily; patient could then speak again and take food, only complaining of intense pain. He died the first of March.

The question arises whether it was advisable to perform the primary operation, and, if this was the case, whether or not there was indication enough for the second and third operation. There is no doubt at all that we had to deal with a case of tubercular affection of the temperal bone, beginning probably with an acute otitis media purulenta and gradually affecting the neighboring portions of the mastoid and occipital bones. All my attempts, with different methods of staining, to find tubercle bacillus in the scooped tissues after each operation failed. The primary operation was performed to give the incarcerated pus in the mastoid a natural outlet, which in most cases of the kind relieves the pain. But even this was only obtained after four months. The infiltration of the lungs had so far advanced that no complete recovery could be expected, but enough cases of this kind are recorded in which after curing the affection of the bone the destructive process in the lungs came to a standstill, and even cases in which complete recovery took place, as already mentioned in case

No. 8. In the second operation I was guided by general surgical rules; we had to establish communication with the middle ear for thorough cleansing. This was obtained by the second operation. The third operation needs only of some explanation as to the formation of the abcess as far back from the primary source. At the time of its formation almost the whole external plate of the mastoid appendix had been removed. In the healing of this wound, according to my opinion, very little or no bone substance was formed (see Case 6); the external integuments, cutis, and periosteum, which were only detached and retracted at the first operation, gradually extended down into the cavity of the bone, forming a funnel-shaped opening. Thus a nail $3\frac{1}{2}$ *ctm* long, which was used, practically was only 2 *ctm*, or a little more, in the bone itself, or I may say in the neck of the funnel. In order to hold this nail in position when the external opening has such dimensions, it must be curved to adapt itself to the posterior surface of the depression, and have besides a little external plate, almost at right angle, adapting itself to the side of the head. This posterior surface of the funnel remained sore by the constant irritation of the nail, as well as by being always moist with pus, and it sometimes happened that pus found its way at this spot between the external plate and periosteum. Generally, however, infiltration takes place and formation of fungous granulations. After the opening of the occipital abscess, the fistula ran through the soft parts until the posterior surface of mastoid was reached, in which a fresh spontaneous opening was found. Thus the occipital abscess was not produced by irritation from the nail and formation of an abscess by gravitation, but by a fresh perforation of the posterior surface of mastoid near the sutura temporo-mastoidea. Although the life of the patient was not materially prolonged, my own experience in Case 8, as well as the statements and opinions of others more experienced than myself, leads me to the opinion that the whole surgical interference was justifiable.

CASE 12.—**Acute Suppuration of Left Middle Ear; Empyema of Antrum; Operation; Cure in Six Weeks.**

M———, male, twenty-one years old, consulted me in the German Hospital, June 25, 1886. He related the following history:

In May he contracted a severe cold, which, a few days later, was followed by severe pain in the left ear. He applied to a specialist in this city, who treated him with leeches and poultices without any benefit. A few days later suppuration set in and the pain decreased. The poultices were then set aside and the meatus filled daily with boric powder by the doctor himself, without previously syringing the meatus. This treatment was continued for several days, but, getting no better, he left for San José, where he used to cleanse his ear several times daily with warm water. From the very beginning of the disease he suffered intense pain; was somewhat relieved when the discharge set in, but as soon as his ear was filled with the powder the pain became more intense, and in a few days the region behind the ear began to swell.

Status Præsens: Patient well built; has always enjoyed the best of health; is now mentally depressed; his complexion pale-yellowish; tongue coated. Copious purulent discharge from the left meatus; after cleansing and drying its walls swelled, thus allowing only a partial view of dark-red membrana tympani. Politzer's method discovered a small perforation. The mastoid region was swollen, œdematous, and sensitive to pressure. Temperature 38° C.

He will not submit to an operation, therefore his whole temporal and part of the occipital region is shaved and repeatedly painted with a strong tincture of iodine. Ice applied interruptedly. Keeps his bed, and twice daily, after inflation with Politzer, the ear is syringed with a 1‰ solution of carbolic acid. July 10th, 11th, and 12th temperature kept at 39° C.; there was no improvement, the discharge still abundant, mastoid region swollen and sensitive; the ice which relieved at first failed to do so now.

July 12th.—He submitted to the operation, Drs. de Vecchi and Richter assisting. Ether narcosis. Incision, from 5 to 6 *ctm* long, through the œdematous tissues, followed by profuse parenchymatous hemorrhage. Periosteum united to the bone, but easy to detach. External plate perfectly normal. Bone very hard with but few small cells. Worked with chisel and mallet to a depth of 2 *ctm*, when the antrum was reached and found full of partly

cheesy, partly fluid pus. Then Schwartze's cylindrical scoop was used to smooth down the very compact bone. In syringing no communication was obtained, the depth from inner wall of cavity to external surface of the bone measuring 2½ *ctm.* Mastoid and wound packed with iodoform gauze. Antiseptic dressing.

July 13th.—Temperature, 38° C.; patient had a good night, no pain; bandage removed, no discharge from meatus at all. The gauze in cavity of mastoid also renewed, dressed otherwise in usual manner with 2 % solution of carbolic acid. This treatment was repeated daily until the 20th of August. The temperature increased to 39° C. to the day of the operation, then decreased gradually to be normal, five days later; his complexion became more natural, his appetite improved. At the end of the first week granulations appeared; he was attended to daily up to the 20th of August, when a lead nail, 2 *ctm* long, was inserted and held by a spring. He left the hospital on the 26th. There being no suppuration at all, the nail was left off on the 28th. By the 31st the fistula had contracted so tightly that it hardly could be seen; the dressing was free from discharge.

A few remarks seem appropriate, inasmuch as, according to statement of patient, it looks as if the first treatment was the cause of the mastoid trouble. We all know that, shortly after the introduction of boric acid by Bezold, of Munich, several authorities bitterly objected to this or any other treatment by which the meatus was filled with any medicament in the form of powder, for the reason that it prevented free outflow, produced stagnation of pus, and direct infection of the cavities of mastoid. Several articles were written pro and contra, both sides quoting cases in their behalf. We are aware that boric in solution as well as in powder, judiciously applied, is one of the best remedies we have as well in acute as in chronic otorrhœa, and the fact that so much harm has been done with it when either not carefully used or pushed to extremes, is not a reason for abandoning it. In this case, I have no doubt, the mastoid affection was produced by the packing of the external meatus with the powder. But if the attending surgeon had enlarged the perforation, inflated the ear, and

after carefully syringing with a solution of boric acid, dried it, applied a moderate quantity of the powder, and packed loosely the remainder of the meatus with absorbent cotton to act as a drain, he could not be blamed. In a similar case, which I will publish in the series of 1887, I found the meatus filled and totally obstructed with a hard substance consisting of dried cerumen, epidermis, boric powder, and pus. In this case the powder was blown into the meatus without previous inspection, when it happened to be an acute otorrhœa in an ear where ceruminosis obturans existed. The skin of the meatus is often very sensitive to carbolic acid, even to the best of Schering's redistilled, which I generally use, the less irritant being Calvert's No. 1, for internal use. When, by the chronic otorrhœa, the walls of the meatus have become sore, denuded of epidermis, nothing has proved to me better than boric powder judiciously blown to cover its surface, and a loose plug of absorbent cotton filling the entire meatus to act as a drain. This cotton plug is the method used in Halle by Prof. Schwartze, and a special forceps is required to properly introduce it.

CASE 13.—**Acute Purulent Inflammation of Right Middle Ear; Empyema Mastoidei; Operation; Cure in Seven Weeks.**

C——, male, fifty-eight years old, contracted a severe cold, end of February, 1886. From 1st to 10th of March he had severe earache on right side, followed by purulent discharge from the ears. He was first treated in the country; came to the city May 24th, and placed himself under the care of Dr. Barkan, who, after trying the usual remedies, made an incision behind the ear, about the 15th of July. I was called in consultation. The doctor kindly advised patient to go to the German Hospital and place himself under my care. July 22d the patient was admitted, having profuse otorrhœa of the right side, and slight œdema of integuments over the mastoid. He complained of spells of severe dull pain in the head. He was kept in bed, had the right temporal and occipital regions shaved, and an ice-bag applied continuously, besides syringing and bathing the meatus several times daily with a warm 2 % solution of carbolic acid; McMunn's

elixir at bedtime. This treatment was followed until July 30th, without any improvement; the pain, which was relieved by the ice, returned as soon as it was left off; the swelling of external integument had decreased; the walls of meatus were swollen, and the otorrhœa as abundant as ever before.

July 30th; Operation.—Drs. Barkan and Morse assisting. Ether narcosis; incision as usual, followed by copious hemorrhage, which was stopped by compression with sponges. Periosteum adherent; external plate of normal appearance. Chisel and mallet used, and at a depth of from 3 to 3½ *mm* pus presented itself. The external opening was enlarged to 1 *ctm* in diameter, and then the scoop was used to empty the inspissated pus from the mastoid, the interior of which was changed into a large abscess, the trabeculæ having been mostly destroyed. The bone substance forming the abscess wall bled profusely; the cavity was filled with iodoform and carbolized gauze; antiseptic dressing. No communication was obtained. He remained in bed two days, and the improvement of his general health was so rapid that it was almost impossible to persuade him to stay in the room. The first dressing, impregnated with blood, was removed the following day, Dr. Barkan being present; then every 24 hours. At the second dressing it was noticed that the discharge had greatly diminished, and in a very few days it totally disappeared, and the swelling of meatus diminished. Forty-eight hours after the operation the patient's appetite and sleep increased, and no more pain was complained of. In very few days the whole cavity began to granulate. He remained in the hospital until August 23d, when a lead nail, 2½ *ctm* long was inserted. He was then treated as an outdoor patient.

August 25th and *26th.*—The nail was shortened; beginning of September left off entirely. The fistula contracted, but was cleansed every second day with a fine cotton-holder and a 5 % solution of carbolic, until September 24th, when he was dismissed perfectly cured. External meatus normal, memb. tympani thickened, and $h = \frac{10}{500}$.

September 24th, 1888, patient made a friendly visit, being in perfect health, having had no further trouble from his ear. Memb. tympani slightly thickened; $h = \frac{10}{500}$. On mastoid two verticle linear scars, 4 *ctm* long: one 1 *ctm* from posterior insertion of auricle, having in its centre a slight depression; the second, about 2½ *ctm* distant from the first.

CASE 14.—**Acute Inflammation of Middle Ear with Periostitis and Mastoiditis; Operation; Cure in Four Weeks.**

John Y——, aged 39, consulted me August 30, 1886. The fourth of July he went sea-bathing in Santa Cruz. On the fifth he had severe earache on right side. He applied poultices, and the ninth day he consulted a specialist, who lanced the ear, from which time on he had purulent discharge. After a week's treatment he noticed a swelling behind the ear. The doctor being absent, he was advised by a physician whom he consulted to come to me. All the time he had suffered excruciating pain, having sleepless nights, loss of appetite, and felt very weak.

A shoemaker by trade he had always enjoyed the best of health; he is a small, heavy-set man. His face wears signs of mental depression. The whole side of his head is œdematous; the whole temporal and especially the mastoid region, very much swollen, of dark livid-red color; temperature raised; pulse exceedingly hard and tense. I advised him to go to the German Hospital, where he was admitted on the 31st of August, and operated on the 1st of September.

Operation: Dr. Morse assisting. Ether narcosis. Auricle very much swollen; meatus hardly permeable from swelling of its walls; profuse purulent discharge. After the usual antiseptic precautions, I made an incision parallel to the posterior insertion of the auricle, 6 *ctm* long, down to the bone. The tissues were lardaceous; infiltrated. At once profuse parenchymatous hemorrhage set in, mixed with about one teaspoonful of subperiosteal pus. A sponge was pressed on the wound for several minutes. When the hemorrhage ceased I noticed that the periosteum was detached from the normal-looking bone. All efforts to discover a fistula in the bone proved fruitless, but I was able to pass my director easily along the posterior wall of the external meatus for about 2 *ctm* towards middle ear. *Spina supra meatum*, as well as the canals for the emissary blood-vessels, well marked. I began to chisel in this place, and after I had penetrated a very compact external plate 4 or 5 *mm* thick, pus began to ooze out, the external opening was made 8-9 *mm* broad, and the interior of the bone thoroughly scooped out. The bone was very firm in every direction. In syringing no communication was obtained. The meatus was well disinfected, and iodoform dressing applied.

September 2d.—Patient had a splendid night, feels refreshed, no fever, has a clearer complexion, likes to talk. In changing the dressing which was saturated with blood but dry, patient fainted. Found swelling of head very much decreased, hardly any discharge from meatus.

September 3d.—Feels so well that he speaks of going home. About same condition as yesterday with some decrease of swelling.

September 4th.—Was allowed to get up. No more discharge from meatus.

September 5th to 10th.—Remained in the hospital; swelling of the head further reduced, confined to the mastoid region. Swelling of walls of meatus diminishing rapidly. Wound granulating nicely. Dismissed from hospital.

From the 11th to 30th came to office, where he was attended to daily. The fistula in the bone was rapidly filling up with granulations, no nail being required, and the lips of external wound had to be drawn together by adhesive plaster. On the 30th he was dismissed cured. Meatus of normal calibre; memb. tympani thickened, slightly injected; neither perforation nor râles upon catheterization. Hearing, $h = \frac{10}{10}$.

The peculiarity in this case is the purulent periostitis combined with the purulent affection of the air cells. It remains to be decided whether the two processes formed independently of each other, or whether the subperiosteal abscess was directly connected with the purulent effusion in the air cells or middle ear. We often observe in inflammation of the middle ear, mostly of a purulent but often also of a purely catarrhal nature, a primary suppurative periostitis mastoidei with formation of a small abcess. In catarrhal cases the explanation of the formation of the subperiosteal abscess is somewhat difficult, unless we believe in a transmission by the blood-vessels.

In the purulent forms we almost always find that the walls of the meatus, especially the upper one, are collapsed, and if we have the opportunity of an examination as I had in this case, a direct communication will be found with the original seat of the inflammation. The cases where pus was evacuated on incision of the collapsed upper wall, are well known.

CASE 15.—**Acute Purulent Inflammation of Right Middle Ear; Caries of Mastoid; Spontaneous Perforation; Pyæmia; Operation during Comatose Condition; Death.**

Boy, H—— b—r, 14 months old. Sept. 6, 1886, at 7 P.M. I saw the child in consultation with Drs. L. C. Lane, Livingston, and S. Kahn. We learned from the mother that six weeks previously the robust and well nourished child had been taken sick with fever and treated to date by a homeœpathic physician. The condition of the child became gradually more alarming and there seemed to have been no decided diagnosis until two weeks before, when a swelling was observed behind the right ear. Some specialist was called in consultation and satisfied himself by prescribing pills to "absorb the congealed blood." The swelling kept increasing, and the condition of the child grew more and more alarming until the 2d or 3d of September, when the child became unconscious and very restless. Temperature 103° to 105°.

Status Præsens: Comatose condition; lids half open; insensibility of cornea; pupils dilated, immovable; slight attempt to cry when examined: respirations very frequent; attempts to swallow, when milk is poured between the lips; abdomen distended. Copious putrid purulent discharge from right meatus; auricle extends out at right angle; behind the same a large abscess; the skin covering it bluish, discolored, and ready to open.

Prof. Lane at once made a large incision emptying 2-3 tablespoonfuls of fetid, discolored, semi-fluid detritus. Syringed with a carbolized solution, free communication existing; antiseptic dressing.

Dr. Kahn took charge of the case during the night and recorded temperature from 103° to 105°, resorting to such internal remedies as the case might call for.

September 7th, A.M.—We met again, and after consultation I was asked to operate. The condition of the child was not materially better but no worse. With the kind assistance of the above gentlemen I operated, under ether narcosis which caused no trouble. After enlarging the incision made by Dr. Lane, we found the bone denuded of periosteum, its external surface rough; close to and at same height with upper wall of meatus a narrow fistula in external plate, into which I was able to introduce my director as a guide. I then enlarged the fistula by means of chisel and mallet, exposing the excavated mastoid appendix, which was filled with a fetid cheesy pus. I carefully scooped it, penetrating surely between 2 and 2½ *ctm;* the inner portions of the bone were soft, especially directly in-

wards, where I am convinced the internal plate was already perforated. A large quantity of carbolized solution was injected into the mastoid until the water flowing freely from the meatus had lost its fetid odor. The cavity was filled with freshly prepared iodoform gauze and an antiseptic dressing was applied.

5 P.M.—The child seemed to have rallied somewhat and I became hopeful; bandage was not disturbed. Some nourishment given with a spoon.

8th, A.M.—We met again in consultation; general condition appeared better, reacting more when handled, otherwise the same; bandage impregnated with pus, removed; thorough syringing with carbolized water; same dressing. 5 P.M.: Same general condition; bandage renewed; discharge very much decreased; not fetid.

9th, A.M.—Had a poor night. Dr. Kahn thought it would die at any time; refuses to swallow. We decided upon feeding with a soft rubber catheter. Bandage almost dry, the discharge having almost entirely ceased. Dressed in the usual manner. 5 P.M.: Coma. Same treatment. Dr. Kahn remained in care during the night, and towards morning of the 10th, after a copious and very fetid evacuation, the child died.

I cannot but reason over the question asked of me by the parents: "Could you have saved that child if called upon when the swelling first presented itself behind the ear?" Let us admit that the physician in charge was a competent general practitioner. He was called to see a child who had fever and was restless, and probably never thought and had no direct cause to believe that the trouble was in the ear. This is excusable and of daily occurrence, and specialists know that often patients, adults as well as children, who pass a restless night from otalgia, upon examination do not show the slightest trace of exudation in the middle ear, not even hyperæmia of memb. tympani. In forty-four to forty-eight hours, or later still, we are astonished to find that spontaneous perforation and exudation has taken place. But there is no excuse, after otorrhœa set in, and especially after a swelling has appeared behind the ear, which has increased daily, to still postpone the surgical interference. No doubt whatever that the child could have been

saved if the operation had been performed as soon as the swelling was noticed. No post-mortem examination was allowed, even objections raised to the probing into the mastoid, but according to the depth I had penetrated and the consistency of the inner portion of the cavity we would have found direct connection with an abcess in the adjoining portions of the brain. The sudden cessation of all discharge was probably due to the lack of vitality.

CASE 16.—**Acute Otorrhœa, Right Side, with Purulent Mastoiditis; Operated Twice; Perfect Recovery in Five Months.**

E. P. H., male, thirty-five years old, consulted me September 7, 1886. Six weeks ago he had a severe earache on right side. He applied to a physician, who could detect nothing abnormal; ordered poultices, and some drops to be applied to the ear. This he continued for one week, suffering almost continually; the ear then began to discharge, but at the same time a swelling appeared in the mastoid region, extending to the whole side of the head and face. When he called he was in intense agony, for which I gave him one teaspoonful of McMunn's elixir with whisky, and sent him to the German Hospital to be ready for operation the next morning.

Status Præsens: The whole right side of the head swollen, œdematous, densely infiltrated, the nearer to the mastoid region the harder and greater the swelling, with peculiar yellowish and pale-red color. The mastoid was extremely sensitive to touch, the patient almost fainting when it was pressed upon. Auricle œdematous, standing from the head; in meatus very copious fluid purulent discharge.

Operation in German Hospital, Dr. J. Morse assisting. Ether narcosis. Patient had been shaved and well disinfected. Incision, 6 to 7 *ctm* long, through the lardaceous tissue, which was about 3 *ctm* thick. Under the detached periosteum pus was collected. In several minutes the copious parenchymatous hemorrhage was stopped by compression with sponges. After drawing aside the periosteum, the external plate was found rough and discolored in a space the size of half a dollar, in the middle of which a small fistula led into the bone. I began to operate with the gouge, but finding the external plate harder and thicker than expected, resorted to chisel and mallet. It was then easily seen that the course of the fistula was very tortuous, running through a compact exter-

nal plate of 5 to 6 *mm* in thickness. The opening was enlarged to usual size of 1 to 1½ *ctm*; the external plate was undermined, very thick, hard, and gaining in thickness towards the occipital region. The destruction of bone substance was extremely deep inward and backward; here in probing no hard bottom could be felt, in certain spots the probe running through granulations which bled profusely. I supposed that at these spots the internal plate was already missing. Besides a great deal of granulation tissue backward and inward, the contents of this large cavity were fluid pus and cheesy substance. During the whole operation the hemorrhage was very profuse, the blood being very dark. The anterior portion was well cleansed with a scoop, less so the posterior portion. In syringing, free communication existed. The cavity was packed with iodoform gauze, producing compression, and antiseptic dressing applied.

September 9th.—The whole bandage was found saturated with blood; the house surgeon had to apply a second one to use more compression. The external dressing removed, the gauze filling the cavity was found thoroughly saturated with blood. It was partially removed, plenty of fresh gauze packed over it, producing considerable pressure. There was no discharge from meatus. Ice applied over the bandage, and patient kept quiet in bed. He had a restless night, and felt faint this morning. Swelling of head and face reduced.

September 10th.—Had a good night, with profuse perspiration. No pain; bandage dry, though bloody in spots. I removed the blood and all the gauze in the meatus which had a dirty-gray color, probably from the effect of carbolic oil.

September 11th.—Splendid night, slight sweats, no pain, wishes to get up. Bandage perfectly dry, first signs of suppuration. Thorough irrigation with carbolized solution; same dressing. Swelling of head very much reduced. Will sit up a couple of hours.

September 12th.—Was dressed when I called. Every thing in perfect condition; wishes to go home. There being no more fear of hemorrhage, he was allowed to go home after treatment.

From the 13th on he came to my office, where he was treated as an out-door patient. The cavity began to granulate nicely, the external surface of external plate was covered with granulations from soft integuments. At the end of September a lead nail was applied, the treatment carried on daily until October 11th, then,

as patient went to work, only twice a week. All discharge from and communication with the middle ear had ceased. In November I saw him four times, in December not at all. Beginning of January he complained of increased discharge from mastoid, and occasional pain, backward and downward; a small pocket had formed where the pus stagnated. I sent him back to the hospital, and scraped the posterior and lower portions of cavity, removing at the same time a part of external plate downward to provide for easy outflow. He was in the hospital two days. February 1st the nail was re-introduced, and kept to the 14th, when it was removed, being yet 1 *ctm* long; the 19th the fistula was perfectly closed, and patient dismissed.

The great destruction of bone inward and backward was caused by the thickness of the external plate, and there is but little doubt that if the operation had not been performed, most likely spontaneous perforation would have taken place toward the brain. There was undoubtedly already some destruction of inner plate, as ascertained by probing; at the same time I could not be positive, for as my probe ran through granulations, producing a great loss of very dark blood, I became somewhat timid, and abstained from penetrating deeper. At first we thought that the very dark color of the blood was due to the deep narcosis, but when we saw the hemorrhage, forty-eight hours after the operation, we had reason to fear that the walls of the sinus were already eroded.

CASE 17.—**Acute Catarrhal Inflammation of Both Middle Ears, with Slight Suppuration in Left Ear; Acute Catarrhal Mastoiditis, Left Side; Operation; Recovery in 13 Weeks.**

J. W——, male, 59 years old, first seen in consultation with Dr. Barkan, August 9, 1886. I was then informed that three or four weeks before, the patient contracted a severe cold, accompanied by pain in both ears, with slight purulent discharge on the left side. He was then treated with leeches, boracic-acid inflations. He hardly heard the watch in contact on right side; *Mt* dull and thickened; feels perfectly normal. Left side, meatus very narrow by swelling of its walls, especially the upper one. A full view of *Mt* could not be obtained, what was seen appeared

dull-red and thickened. Very slight purulent secretion. Mastoid region normal; no sensitiveness upon pressure. With the catheter a few râles heard, air penetrating only on strong pressure, and not followed either by subjective relief or by improvement of hearing. Patient physically well developed, has never been seriously ill, and led a very active life. He feels mentally and bodily depressed, complaining of fulness in the head, but no special pain. The family physician, Dr. Storror, noted that Mr. W—— was "running down," had cold sweats, slight elevation of temperature at bedtime, tongue dry and coated, appetite poor, restless at night. Sulphate of quinine and other remedies were prescribed. I suggested the bathing of the ear every two hours with a warm 1 % solution of Calvert's No. 1 carbolic acid, and then a warm Priessnitz bandage applied, besides inflations with the catheter. Patient felt relieved in a couple of days, the discharge ceased entirely, and the swelling of meatus diminished. Dr. Barkan then left him in my care. I attended to him daily at his residence until the 17th; he then came to my office three times. August 20th he stated that if his general health were better, he would not think of his ear, except that the hearing had hardly improved. *Mt* could now be better inspected; it was of an even pale-red color, and thickened; no signs of perforation visible; $h = \frac{c}{500}$; air penetrates easier; no râles. He expressed the wish to go to the springs, and I even advised him to seek a warmer and more equable climate, and upon his return to go to Dr. Barkan. I never heard of him again until October 11th, when I was requested to go to see him. I found him with his right ear bandaged, from which he had been suffering for the past few days. He stated that he had been in the country a few days, but, feeling no better, and fearing more trouble with his left ear, had returned and applied to his aurist as agreed upon. Finding no improvement, he decided to let the ear trouble alone and take its own course. He had, all the time, the cold sweats and slight fever at night.

Status Præsens: Right side relapse of acute catarrh for the last few days, accompanied by pain. Hearing $h = \frac{0}{500}$; voice hardly heard unless very close and loud. *Mt* very much injected, details not well visible. Under Priessnitz bandage and inflations with Politzer or catheter twice daily he recovered in a few days. Yet his general health was very poor; he had lost considerable flesh, his complexion was livid, almost icteric, tongue coated, and had cold sweats day and night.

October 15*th.*—The left ear had not changed materially; there was no redness nor swelling of mastoid region, but great pain upon pressure at spot of selection. He was so much afraid of what he had undergone that he requested me not to touch that ear. I called his attention to the fact that probably the bone was affected; that this was the only cause of his general debility, and advised him to send for proper assistance as soon as he had the least trouble.

October 16*th.*—Early in the morning I was sent for. I found him sitting by the fire resting his head on both hands, mentally depressed, having suffered all night dull pain in the head and shooting pains in left ear. As soon as he saw me he requested me to open his skull or do any thing I wanted; he was prepared for the worst. I expressed the wish to have a surgeon in consultation and for assistance. His friend, Dr. L. C. Lane, being his choice, I went to the doctor, who advised the operation without delay.

October 17*th*, A.M.—Operation with the kind assistance of Dr. Lane; ether narcosis by Dr. Whitwell. The usual precautions of shaving and disinfecting taken, I made an incision 5–6 *ctm* long through the slightly œdematous tissues to the bone, and separated sideways the periosteum, which firmly adhered to the bone. External plate perfectly normal; *spina supra meatum* well marked as well as emissary canals. With the broad chisel and mallet I removed the external plate, which was very compact and 4 to 5 *mm* thick. I came then to a relatively softer and very vascular portion of bone. Sharp and cylindrical spoons were used in removing partly the trabecular, partly the spongy and swelled degenerated bluish-looking mucous membrane. The mastoid of large size was very rich in cells but none of considerable size not even what was supposed to be the antrum at a depth of almost 3 *ctm.* Hemorrhage from the bone was copious, and no pus was observed. The cavity was filled with iodoform gauze; antiseptic dressing. 6 P.M.: Has been restless, and experienced pain in the head, probably from the wound.

October 18*th.*—Restless night, some pain, cold sweats, and slight elevation of temperature. The whole family noticed already this morning that he had a clearer complexion and his eyes were brighter. His neck and head felt sore. He asked if after a while he could take some breakfast. Tea and toast were allowed. The bandage was saturated with blood, but dry. It was removed

with the exception of the gauze in the wound, which was sticking firmly to the parts. The wound was thoroughly syringed with a tepid 2 % solution of carbolic acid until it appeared clean and disinfected, then external dressing applied in usual manner. P.M.: Had a fair day, slept some, complained only of soreness of neck.

October 19th, A.M.—Had the best night he ever had for months, no fever, felt and looked like a different man, asks for a more substantial breakfast, and inquired if some grouse that was sent to him would be an appropriate dinner. Dressing perfectly dry, removed, as well as some of the gauze in wound; dressed again in same manner.

October 20th.—Wound began to suppurate, patient got up and sat on a chair for treatment. He again began to take interest and inquired about his business. All the gauze in the bone was removed and renewed.

I have given the above details for a couple of days to show what a wonderfully beneficial effect the operation had in a few hours; Dr. Lane himself, our experienced and renowned surgeon, expressing himself that he had never seen such a remarkable change after an operation. From date of operation to the the 23d I visited and dressed patient twice daily, then once daily till November 3d. The whole cavity soon began to granulate rapidly, compelling me, Nov. 4th, to apply a lead nail over 2½ *ctm* long. From now on he attended to his business; he was treated in my office daily until January 21st. In December no material change was made in the nail, but in January it was rapidly reduced in size, and about the middle of the month left out entirely. The fistula contracted and was cleansed at first daily and then every second day with a fine cotton holder and 5 % carbolic solution, the holder penetrating from 1 to 1½ *ctm.* deep. End of January dismissed him cured with hearing power $h = \frac{1}{500}$. No communication was ever obtained. In October, 1887, he came to see me on private business. I found: R side, $h = \frac{100}{500}$; L, $h = \frac{5}{500}$. From the cicatrix a vertical calloid has formed, 0.03 long by 0.015 wide and 0.005 thick; its upper end is broad and gradually declining, ends pointedly downward in a depression of the external plate of about 0.01 in depth.

A very remarkable feature in this case is the lack of local pain during the whole affection until the night of the 15th

of October. There is no doubt that the catarrhal affection in left mastoid existed already at the time of our first consultation, as was indicated by the condition of his general health, though we must admit that the infection of the blood with pathological secretion or products cannot be explained in a case of catarrhal inflammation of the mastoid cells as well as in cases of caries or empyema. In the catarrhal affections one would expect more symptoms of irritation of the meninges from congestion, which were totally absent in our case. The peculiar livid, almost icteric, color of the skin, the loss of appetite, the coated tongue, and slight fever, so characteristic for all affections of the mastoid, show to satisfaction that they are produced by a slight and slow degree of septicæmia. This is proven by the wonderful improvement following every operation. Far from placing my patients under restricted diet, I allow them, from the second day of the operation, all they wish to eat, with wine or liquor if accustomed to it. Few patients are kept in the house longer than one week; being well bandaged, they are allowed to go out as soon as possible.

CASE 18.—**Acute Purulent Inflammation of Right Middle Ear; Periostitis Mastoidei with Abscess; Acute Catarrhal Inflammation of Air-Cells, with Swelling and Degeneration of Mucous Membrane; Operation; Recovery in Four Weeks.**

Miss M., æt. twenty-two, was recommended to me by Dr. James Simpson, her family physician. The first days of October she contracted a severe cold, and a couple of days later had catarrh on right side. Failing to improve under the usual care and treatment, she was advised to apply to me. I found externally auricle normal, mastoid region slightly œdematous and sensitive to pressure, meatus contracted, greenish purulent secretion in moderate quantity. No good view of *Mt* could be obtained; as far as visible the *Mt* was injected, and had a pulsating perforation in its lower portion. She had constant dull pain, with spells of shooting pain, the last especially during the night, when temperature rose slightly. I confined her to bed; after cleansing the ear I applied moist Priessnitz dressing, and every three hours ear baths with

warm water; McMunn's elixir of opium at night. This treatment was followed without any material improvement until October 24th, when the swelling in mastoid region had increased sufficiently to give fluctuation, while the subjective symptoms had remained about the same.

October 25th.—Operation, with the kind assistance of Dr. Blakie, of England, as a guest, and Dr. W. Kerr, of this city. Ether narcosis; incision in usual way, emptying half a teaspoonful of pus from subperiosteal abscess; naturally the periosteum was detached from the bone, and with a slightly curved probe I could penetrate as far as the middle ear, showing that the soft integuments of posterior wall of external meatus were totally detached. External plate normal, about 3 *mm* in thickness, when the air-cells were reached. These were totally filled with a dark-red, pulpy, gelatinous substance. The scoops were then used to a depth of about 2 *ctm*, when the antrum was reached. No more pus was found and no communication obtained. Dressed in usual manner. The following night was the first good one without an opiate; the slight elevation of temperature in the evening subsided. Already at first change of dressing the suppuration from meatus was very slight, and kept decreasing every day, and at the end of the week meatus was perfectly dry, its walls having a normal appearance. *Mt* closed, uniformly injected, pale-red in color. The wound as well as the cavity in mastoid was granulating, and at the end of the fourth week the healing process was at an end. No nail was applied, and the dressing was changed once daily. At the end of six weeks hearing $h = \frac{10}{100}$ by slightly thickened *Mt* and a hardly retracted linear cicatrix on mastoid.

This case shows that the subperiosteal abscess was in direct communication with the middle ear, as probably most of these abscesses are. The location of the pus as well as the normal appearance of the external plate might have induced a good many to desist from chiselling open the bone, and this is the course general practitioners follow. As a rule, I also admit that it is the best plan for relief, and in a few days it can easily be decided whether or not further surgical interference is needed, thus giving time to call in the specialist.

CASE 19.—**Chronic Otorrhœa Left Side; Cholesteatoma Mastoidei Followed by Suppuration; Spontaneous Per-**

foration under Periosteum; Operation; Almost Complete Recovery.

Fred. D——, male, nine years old, from San José, was first brought to me June 9, 1886, with chronic fetid otorrhœa left side. After cleansing I found *Mt* totally destroyed, the middle ear filled with dried epidermoid substance, after the removal of which a small polypus was noticed filling the upper portion of the cavum tympani. With catheter the air passed freely. The polypus was removed with the snare and the child sent home with directions to syringe the ear daily with a saturated solution of boracic acid. No pain spontaneously or upon pressure on mastoid process. November 16th the child was brought back. The ear had been attended to as directed, but the discharge had not decreased; the general health was poor, and the attending physician treated the patient for malaria. The past few days the mother saw a swelling behind the left ear, which had been noticed once before when the ear stopped running, but it disappeared as soon as the discharge had returned.

Status Præsens: Pale-yellow complexion, tongue coated, temperature 38°, from the left ear fetid purulent discharge with accumulation of epidermoid masses. After removing them by syringing and forceps I found *Mt* totally destroyed, but no granulations. Auricle standing almost at right angle; behind the same the whole region of mastoid extending upwards in the temporal and backwards in the occipital region very much swelled; the skin of purple color, sensitive to touch, and fluctuating. We agreed to operate the next morning. The same evening the mother came to see me, stating that the ear was discharging very freely and that the swelling had decreased so much that she thought an operation could be avoided.

November 17th.—I called at the house prepared to operate. I found that the discharge had been very copious and the swelling of abscess reduced to one third.

Operation: Ether narcosis by Dr. Whitwell, Drs. de Vecchi and Olino assisting. The usual shaving and disinfecting was first done. Incision 4 to 5 *ctm* long, emptying a teaspoonful of pus. The skin was atrophied, and under it there was a quantity of granular substance. Periosteum destroyed in this vicinity, bone bare, its external surface discolored, and though no fistula was found its surface was perforated by fine holes very much like a sieve. No attention was paid to the topographical position, and as atrophy

of the external plate was expected no chisel was used. A gouge applied to the discolored spot liberated fetid pus as soon as the first particle of bone was removed. The opening was enlarged in every direction, first with the gouge as far as the atrophy of external plate allowed, then by means of chisel and mallet. An almost round opening 2 *ctm* in diameter was made, exposing the contents of the cavity, which were masses of cholesteatoma and cheesy substance irregularly arranged, packed together, surrounded by pus, and at certain points by granulations. They were carefully removed with the scoop, while an assistant kept syringing, very free communication with the meatus existing. The cavity thus laid bare was very large and surely extended further backward than the natural limits of the mastoid appendix of a child. In order to prevent stagnation of pus all of the undermined portions of the external plate that could be removed were carefully snipped off with Luer's sharp bone forceps or with the chisel, and the edges were smoothed with a gouge. The external opening was now no less than 2½ *ctm* in diameter. The hemorrhage, after scraping the contents, was apparently slight but very steady, and proceeded mostly from the bone substance, but to judge from the amount sponged off it was quite considerable. The cavity was first well lined with iodoform and packed with iodoform gauze. which was also applied to external meatus, besides antiseptic dressing. In the evening he felt well—was sleeping when I came. Finding the bandage dry and in order I did not disturb him.

November 18th, A.M.—Had a restless night, face flushed, temperature 39°. Bandage saturated with blood, but dry ; removed external dressing and a portion of the gauze filling the cavity (the gauze is cut into small stripes about 3 *ctm* long by 2 wide, well saturated with carbolized water and iodoform, and always freshly prepared). The plug of gauze in the meatus was also removed and found free from pus. Milk diet. In the evening, temperature 39.2° ; had a good day, having toys in bed ; no pain.

To avoid repeating facts of little interest to the reader I will leave out unnecessary details. After the 19th of November the temperature gradually fell ; he was kept in bed four days and then confined to his room six days longer, the dressing being renewed once in twenty-four hours. From the tenth day after the operation he was able to call at my office, where he was treated daily as an out-door patient till end of January, 1887, when he left

for home well supplied to be attended to by his father. The large cavity began to fill up with granulations, mostly from the posterior border of the soft parts; these granulations gradually worked their way into the cavity and lined it so rapidly that four weeks after the operation I had to fit in a nail 2½ *cm* long. In February he called five times; last, on the 26th, to have a larger nail inserted. His general health has improved wonderfully, yet there is always some slight purulent greenish discharge from the meatus none to speak of from the fistula; at times also small scales are syringed out. It could be ascertained by careful probing that the whole cavity, with the exception of the opening for the nail, was totally healed and nowhere undermined. During May, June, and July I gradually reduced the nail and then left it off entirely, because it had been reduced in length and size sufficiently, and that after being out several minutes the fistula had contracted so much that it was difficult to introduce it again. In each of the months of August, September, and October I saw the patient twice. The fistula had firmly closed with a certain amount of depression, as would be expected, but there was no sensitiveness upon pressure. The ear had been syringed daily; it still discharged slight greenish pus. In 1888 I saw him once, finding no material change; but on June 11th he presented himself, the discharge having increased and become fetid. I found some dried epidermoid masses in the middle ear, and after their removal small granulations, which were cauterized several days with chromic acid, and by the 16th had totally disappeared. The 23d he left for home with almost no discharge, but with the strict injunctions to syringe his ear once daily with tepid water, followed by instillations of sublimate 1:2000.

July 30th.—Upon a last visit the condition of his ear was still satisfactory.

The benefit in this case from the operation is surely incontestable, but yet the accumulation of cholesteatomatous masses in the cavum tympani and the occasional formation of granulations indicate that there is still some danger. The thorough evisceration of the mastoid and the way its cavity filled up, namely, by the healing into it of the retracted external integuments, such as periosteum and cutis, minutely watched until a fine conical nail could hardly be introduced after having been left out a few minutes, satisfy me that in this region no more danger has to be looked for. Un-

doubtedly there is still some caries, which is proved, first, by the recurrence of granulations, and then by the still fetid suppuration, no matter how slight it may be, in an ear which is daily syringed with disinfecting solutions. The case will remain under observation and be reported later on.

(*To be continued.*)

INVESTIGATIONS UPON BACTERIAL INVASION OF THE LABYRINTH IN THE COURSE OF MEASLES.

By S. MOOS, of Heidelberg.

(With eleven lithographic illustrations upon plates i.–vi., and a colored plate, table vii., of volume xviii., German edition.)

Translated by Dr. Max Toeplitz, New York.

I.—Pathologico-Anatomical Part.

I RECEIVED two petrous, with notes referring to them, from a friend not residing in Heidelberg. They were taken from a boy, three years old, who was admitted to the hospital on December 12th with morbilli. and died on December 19th.

Post mortem: Catarrhal Pneumonia.

I did not receive any notes with reference to the condition of the auditory organ during life.

Results of Examination of both Petrous Bones.

Both drum-membranes are united to the promontory, lustreless, yellow-red, handles of malleus not visible. Both tubes permeable for a probe of 1 *mm* in diameter, in appearance unchanged. The tympanic cavity is filled by a gelatinous exudation, the mucous membrane being extremely thickened to the extent of 3 *mm* in diameter, enclosing the ossicles; on the left side the changes are more marked than on the right. The gelatinous exudation consists of granu-

lar corpuscles and epithelial detritus. The microscopical examination of the mucous membrane of the labyrinthian wall gives the same result on both sides.

The Mucous Membrane of the Labyrinthian Wall. Microscopical Examination.

The deeper stratum, the periosteum proper, was hyperplastic, and penetrating largely into the neighboring bone, which thus presented a sinuous appearance. The proliferated periosteum had in places cut off the bone, so that in the centre of the hyperplastic tissue osseous discs partly roundish, partly oval, were visible.

The proliferated periosteum, devoid of cells, was in many portions covered by isolated or grouped colloid spherical bodies. The stratum covering the proliferated periosteum was distinguished by its bright appearance. A delicate reticulum of spindle-shaped cells and thin fibres of connective tissue form their basis; in the lacunæ of the reticulum numerous large yellow, homogeneous colloid bodies could be seen, isolated or in groups; also large round, oval, and pear-shaped cells. In the midst of this bright zone were small and large defects, imparting to the mucous membrane a fenestrated appearance even when seen with a magnifying glass. Portions of the mucous membrane were *extremely vascular*, but the greater portion of the vessels was thrombosed and obliterated; in some the contents were in granular disintegration, and wherever they were empty a *fatty* degeneration of the endothelial cells could be plainly demonstrated. In other places of the labyrinthian wall there existed a hemorrhagic infiltration of the mucous membrane.

JOHNS HOPKINS HOSPITAL JUN 19 1890

Niche and Membrane of the Left Round Window.

The entire niche is hermetically filled by a large fibrinous clot, enclosing numerous red and some white blood corpuscles, an evidence of previous intense congestion. The laceration of the vessels of the destroyed mucous membrane of the posterior osseous frame of the niche could be demonstrated as the source of the hemorrhage; from this point pseudo-membranes could be traced into the centre of the

coagulated deposits. In the lower half of the membrane of the round window was a perforation, which was filled by coagulated fibrin, and was connected with a similar mass attached to the inner surface of the membrane in its entire surface of the scala tympani.

The niche of the right oval window and of the right stapes was filled partly by hypertrophied mucous membrane, partly by fibrinous exudations of the same character, as in the niche of the left round window; they were much larger, and enclosed larger groups of red blood-corpuscles, and more colloid bodies. Upon the promontory numerous lacerated blood-vessels could be seen. The limbs of the stapes were enveloped by the hypertrophied mucous membrane, which was covered by numerous granular cells. The stapedio-vestibular connection was normal. In the centre of the stapedial capitulum a portion of the bone was transformed into colloid substance (*cp.*, fig. 7); in that of the respective stapedial plate two such could be found (further mentioned later).

The histological changes in the labyrinth can be arranged *in two large classes.* The *first* class comprises changes due to a *purely mechanical condition*, coagulation of the lymph, gathering or aggregation of lymphoid cells, either isolated or in numerous groups occupying the *semicircular canals* and ampullæ, the inner cavities of the utriculus and sacculus, the right vestibule close to the free wall of the utriculus, and the cochlear turns of either petrous bone.

The results of some of these histological examinations are precisely the same as those in diphtheria, but they partially differ from these, inasmuch as the products of *retrogressive metamorphosis* of the lymphoid cells themselves and of the histological elements are perhaps less the *direct* than a *secondary consequence* of the morbific virus, owing to *thrombosis extending over the entire petrous bone.*

The *blood-vessels* of both petrous bones were tortuous and engorged. This globular stasis resulted in a general thrombosis, which extended through the entire labyrinth to the vas spirale and the capillaries of the stria vascularis. A few blood-vessels are empty. This general extension of the

thrombosis may be *explained by a more or less advanced fatty degeneration of the endothelium of the blood-vessels.*

As is well known, the blood remains fluid within the vessels as long as the epithelium is intact and the blood itself is in motion. The degenerated endothelia are probably partially detached, or perish by disintegration; and, since no regeneration takes place, the denuded rough places become the cause of coagulation and thrombosis. The thrombi *should, therefore, be regarded as autochthonic.* This condition of the endothelia corresponds closely with the observations first made by Ponfick that, in certain severe infectious diseases, the vascular endothelia undergo a fatty degeneration in great numbers, and are cast off. Ponfick[1] has demonstrated this condition in typhus recurrens in the living.

Special Condition of the Thrombi, according to their Situation.

Although the thromboses found in the blood-vessels, as stated above, may be attributed to a common cause, viz., the fatty degeneration of the endothelia of the vessels, their condition, nevertheless, presented a different appearance. In accordance with the character of the contents, *three large classes* may be distinguished.

The majority of the thrombi belong to the *first* class, comprising the smaller veins and the capillaries. Their contents consist mostly of red blood-corpuscles; the thrombus, nevertheless, does not present a red appearance; the red blood-corpuscles, being closely pressed together in consequence of the stasis, are irregular, flattened, and even polygonal. In an apparently later stage, they are markedly pale, in consequence of shrinking, defects are found, and a more or less wide and bright zone (*cp.* fig. 4) between the contents of the blood-cell and its wall. Besides there are found, mostly within the vessel, products of molecular detritus, and, if the products of disintegration are absorbed, smaller and larger defects as bright spots.

The *second* group is chiefly represented in the arterial and

[1] "Anatomische Studien über den Typhus recurrens."—*Virchow's Archiv*, vol. lx., p. 153.

venous vascular area of the *modiolus*. The thrombi are here plainly distinguished by a mostly *red*, sometimes orange, ochre-yellow, or clay-like *color*, although red thrombi are, as is well known, only met with in vessels of larger calibre. This alone should especially arrest our attention, the more so as G. Schwalbe[1] has recently studied and illustrated the anatomy of the vessels of the modiolus more thoroughly, and has also discussed them physiologically in a classical manner.

In the screw-shaped central canal of the modiolus an arterial coil is formed. Schwalbe gives an accurate description of the same in guinea-pigs, and distinguishes glomeruli arteriosi cochleæ majores, which, however, are not connected with each other, although their borders may overlap, and glomeruli arteriosi cochleæ minores. *According to Schwalbe, we have before us in this arrangement, as it were, a powerful current-breaker*, which causes an extraordinary diminution of the pressure and rapidity of the arterial blood, which enters through the cochlea and circulates within this beautiful apparatus, so well adapted to powerful resistances. This is effected (1) by the numberless windings, bendings, and loop-formations of the circulatory path, and (2) by the extraordinary elongation thus produced.[2] From the capillaries of the ligamentum spirale numerous veins develop, which run downward and thence as *radial* veins, with the upper side of the corresponding intermediary partition wall, centrally to the "*vena spiralis modioli.*"

[1] Ein Beitrag zur Kenntniss der Circulationsverhältnisse in der Gehörschnecke (Contribution to the Knowledge of the Circulatory Relations of the Cochlea). *Cp.* Beiträge zur Physiologie (Contributions to Physiology), Dedicated to *Carl Ludwig*, on his seventieth birthday, by his pupils, p. 200–220. (*G. Schwalbe* gives a description of the anatomy of the ear in his "Anatomie der Sinnesorgane," 1887, p. 289–559.—*H. K.*)

[2] Although not strictly relevant, I cannot forbear quoting the following physiologically most important sentence, *l. c.*, p. 216: "If we review the circulatory conditions just described, there results a most surprising relation of the scalæ to the arterial and venous circulation. The scala tympani is surrounded only by *venous* vessels, while the *scala vestibuli* covers within its wall the *arterial vessels*. The scala tympani, which is separated from Corti's organ only by the thin membrana basilaris, escapes, therefore, the influence of arterial pulsations; all arterial paths surround the scali vestibuli, which itself is, moreover, separated from Corti's organ by Reisner's membrane and the entire ductus cochlearis. We may call the scala vestibuli the *scala arteriarum*, but the scala tympani the *scala venarum*.

It is obvious, that if these blood-vessels in the normal state already diminish by their tortuous structure the pressure and rapidity of the blood circulating in them, these factors must increase every pathological effect which produces stasis. The effect is, therefore, that in these vessels the signs of stasis appear earliest and most intensely. This is in accordance with the result of examination.

The red or yellow-colored thrombi within the tortuous blood-vessels of the modiolus consist of more or less numerous *parietal* leucocytes, with or without nuclei, which extend in places even up to the centre of the vessel, in the centre of the vessels of red, rarely normal, mostly already disintegrating blood-corpuscles, granular products of disintegration of the latter and of the blood-discs also, now and then white or gray irregular granular plates, the whole being interlaced with fine-threaded fibrin. In the thin transverse sections fine fibrin threads may be seen passing through the entire lumen of the vessel. In the centre of the vessel we do not unfrequently find, in consequence of complete disintegration and beginning absorption of the contents, empty spaces, as in the first groups. The orange-yellow or ochre-colored character of the contents is, of course, due to a diffusion of the blood pigment, and indicates probably an early development of the thrombosis. These thrombi resemble, with reference to the contents, mostly the "*leucocyte thrombus*," produced experimentally by Zahn.

From the thrombosed vessels of this second group an emigration of blood-corpuscles takes place into the perivascular lymph-space; for we find therein red blood-corpuscles, as well as cells containing blood-corpuscles. Schwalbe, in his above-mentioned work on the cochlea of the guinea-pig, describes a circumvascular lymph-space as well around the vena spiralis modioli as around the arterial wall of the glomeruli. I can confirm his statements in this respect with regard to man, and also with reference to his description of the existence of a fine reticular nucleated small band of connective tissue within the arterial circumvascular lymph cavity.

Thrombi similar to those in the modiolus were also found in the convoluted vessels, surrounded by bone, which send their branches to the maculæ and cristæ of the sacculi and ampullæ. The vascular wall, however, is here also not in direct contiguity to the osseous wall, but is separated from it by a perivascular lymph cavity.

The third group of thrombi is found in the *Haversian canals.* These are only exceptionally normal. But even then at least the form of the blood-corpuscles is no longer normal, but of the same character as in the first group. Others present, chiefly, besides products of disintegration of the blood-corpuscles, only *threaded fibrin;* after disintegration and absorption of the blood-cells the majority presents *only the threaded fibrin,* and consequently complete *obliteration* of the small canal.

Weigert has lately published a method of staining threaded fibrin with anilin upon the slide, a method which has afforded the most beautiful results in the changes of the Haversian canals just described.[1]

Sequelæ of Vascular Thrombosis.

a.—SEQUELÆ RESP. CHANGES IN THE VESSELS THEMSELVES.

If the blood-vessel remains thrombosed for a long period the nutrition of the vascular wall must of course be interfered with on the part of the vasa vasorum. We actually find in the different regions of the labyrinth, viz., in the modiolus and the perilymphatic space of the semicircular canals and ampullæ, a fatty degeneration or a complete destruction of the wall elements and consequently a bright, homogeneous wall, devoid of epithelium or a hyaline thickening of the wall, here and there with dark, fine streaks or curved lines as the last remnants of the cellular elements (*cp.* fig. 4.); the vascular wall even may in the area of the hyaline degeneration undergo such a complete disintegration as to leave only aggregations of the brownish disintegrated contents enclosed by fragments of the disintegrated vascular wall.

[1] *Cp.* On a New Method of Staining Fibrin and Microörganisms.—*Fortschritte der Medicin,* 1887, No. 8, p. 228 *ff.*

In the larger vessels, chiefly in the area of the arteria auditiva interna and its branches, the thrombosis leads to *necrosis of the vascular wall, to laceration, and to hemorrhages.* Such hemorrhages or blood-extravasations in the act of pigment metamorphosis were found in the trunk of both auditory nerves, also in the modiolus of the first cochlear turn (*cp.* fig. 1.); also laterally from the nervus ad sacculum and ad utriculum, and finally upon the mucous membrane of the labyrinthian wall and the niche of the round window. As far as the hemorrhages occur in the area of the acoustic nerve and its branches, the auditory nerves undergo, as already described in hemorrhagic pachymeningitis and in diphtheria, destruction and necrosis, and precisely as in the latter, accompanied by formation of granular cells, disintegration and atrophy of the nerves, and according to the size and volume of the hemorrhagic exudation we have smaller and larger defects in the nerve tracts. In the right acoustic such a defect measures $\frac{3}{4}$ *mm* in diameter. Similar but smaller defects were found on the side of the ramus sacculi (right petrous bone). We still see here and there in the defects the perineurium, deprived of its structure, occasionally studded with pigment granules in the shape of a rosary.

b.—INFLUENCE OF THE VASCURAR THROMBOSIS UPON THE INTERIOR MUSCLES OF THE EAR.

Unfortunately I have neglected to study the relations of the musculus tensor tympani in this direction, but I am able to offer information upon the influence of the thrombosis of the vessels of the stapedius muscle upon the latter and its nerves.

The Changes of the Stapedius—Partial Waxy Degeneration of the Muscle.

The respective specimens presented, even when seen with the naked eye, or with a magnifying glass, isolated bright spots or defects, reaching 1 *mm* in diameter, which only contained the empty sarcolemma tubes.

Staining with picrocarmine gave the muscular fibres, in which the transverse striation was still preserved, a beauti-

ful red color, while the altered fibres appeared greenish or green-yellow. The change begins in the centre of the muscle. Glycerine specimens, when examined with a higher power, showed that in some muscular fibres the nuclei and the transverse striation had disappeared, whilst the fibre itself appeared wider than normal, was colorless, homogeneous, gelatinous, or waxy, and, where the degenerated fibre protruded into the area of the above-mentioned defects, the gelatinous contents were already transformed into a finely granular detritus, and the fibre was collapsed and narrowed. Some fragments of the disintegrated muscular fibres were of a similar character. The sarcolemma was folded in places, otherwise normal. In the above-described defects we found an additional large number of normal sarcolemma tubes, covered in some places by groups of colloid bodies. The *nerve branches* supplying the stapedius muscle were partly in a state of disintegration of the myeline substance, partly in that of complete atrophy.

The blood-vessels in the interior of the muscle were thrombosed.

We have therefore before us a transformation of the contractile muscular substance of the primitive bundles of the stapedius, as was first described by Zenker as occurring in the larger muscles of the body after typhoid fever, in the form of waxy degeneration, and as was experimentally observed by Cohnheim [1] and Weil,[2] by the former after total ligature of the tongue, by the latter after ligature of its artery.

Finally, I will add, that the examination of the just-described specimens of the stapedius muscle gave a negative result with regard to microörganisms.

c.—INFLUENCE OF THROMBOSIS UPON THE LIGAMENTS AND THE ENDOTHELIAL CELLS OF THE SEMICIRCULAR CANALS AND THE AMPULLÆ, UPON THE SO-CALLED LABYRINTHIAN LIGAMENTS, UPON THE MEMBRANA PROPRIA, AND THE EPITHELIAL STRATUM OF THE MEMBRANOUS CANALS.

The fibrillar structure of the *ligaments* has disappeared; the fibrillæ are chiefly replaced by granules, arranged like a

[1] "Untersuchungen über die embolischen Processe."
[2] *Virchow's Archiv*, 1874, vol., lxv., p. 253.

string of pearls, which finally disintegrate; the ligaments thus become atrophied, rarefied, or perish. We therefore find in some specimens only a few narrow bands as remnants of the ligaments traversing the perilymphatic space. The membranous wall of the semicircular canals and of the ampullæ consequently loses its supports, it collapses and presents, instead of the sharp elliptical form, either the shape of a club, that of a pear, or that of a kidney, and in the extreme degree of atrophy of the ligaments the form of a horizontal paragraph mark, so as to bring the opposite wall in contact with each other. Besides, the *endothelial cells* undergo a retrogressive metamorphosis; in the earliest stage they show a dark, extremely granular appearance, or they resemble granular cells; this is also true of the lymphoid cells, which lose their nuclei prior to their complete disintegration. Finally all products of disintegration form a fine, molecular detritus, which is situated between the meshes of the remaining atrophied ligaments.

The membrana propria loses its striated character and presents a homogeneous, transparent appearance. The epithelial cells lose their nuclei, their framework frequently being alone preserved, or they disintegrate entirely. The canal is deprived of epithelium on its inner wall, exceptionally empty, or more or less filled by products of disintegration of the retrogressive metomorphosis, the material of which is furnished by the epithelial cells, as well as by the lymph of the endolymphatic space, or by the hyaline products (*cp.* fig. 3). The more or less complete filling of the endolymphatic space by such products of the retrogressive metamorphosis thus presents, in spite of atrophy of the ligaments, the collapse of the membranous wall (*cp.* fig. 3). As an accessory product of the tissue disintegration, a great many bundles of margarine needles are seen in the perilymphatic as well as in the endolymphatic space.

Results of Staining.

If we stain the above-described parts of the membranous hollow structures of the semicircular canals and ampullæ with picrocarmine, then *everything remains pale*, the mem-

brana propria becomes yellowish, and in no place does a red staining become apparent.

d.—INFLUENCE OF THROMBOSIS UPON THE PERIOSTEUM OF THE OSSEOUS SEMICIRCULAR CANALS AND THE AMPULLÆ.

The changes of the periosteum in measles differ from those in diphtheria essentially by the fact that in diphtheria the periosteum is either hyperplastic or atrophied, while in measles hyperplasia is never encountered. Moreover, the thrombosis produces throughout, in consequence of necrosis of the vessels, also a disintegration of the periosteum and a necrosis of the bone; its sharp outline is lost, and it appears sinuous, with jagged edges.

In those areas, in which a hyaline degeneration exists in the perilymphatic space, the periosteum may also take part in the hyaline transformation.

This *change of the periosteum* has a considerable *influence upon the nutrition of the adjoining osseous tissue*, producing smaller or larger defects with sinuous, ragged edges; these defects are sometimes filled by additional extremely fine and bright masses of detritus.

The osseous frame of these defects does no longer appear like connective tissue, but is bright, finely fibred, and poor in bone corpuscles. In the adjoining territories, which are free of defects, the bone corpuscles are no longer normal. Some are stunted, without processes, the majority in *fatty degeneration*, a change, apparently preceding the complete disintegration of the bone tissue, the products of which are sometimes, as stated above, encountered within the defects.

e.—INFLUENCE OF THE CHANGE OF THE HAVERSIAN CANALS UPON THE OSSEOUS TISSUE, VIZ.:

1. Influence of the obliteration;
2. Influence of the colloid degeneration of their endothelium upon the bone;
3. Influence upon the medullary substances.

1.—*Influence of the Obliterated Haversian Canals upon the Compact Bone Substance.*

The obliterated Haversian canals have throughout a finely striated character, and take with the above-mentioned *Weigert's* method of aniline staining a beautiful blue color upon the slide. If we examine a section from a territory of compact bone substance, stained with picrocarmine (fig. 5) *e. g.* from the cochlear capsule, we find in the midst of the bone tissue a larger or smaller number of unstained bright spots. These spots, resembling either narrow or wide homogeneous, gelatinous bands, are bounded by dark, mostly indented lines against the red-colored bone tissue (*cp.* fig. 5, lower fifth). These bright stripes apparently represent the basis-substance of the bone, in the act of decalcification or entirely decalcified. Occasionally one or more bone corpuscles are still seen in it, which have already lost their processes or present a spindle-like appearance. In many places the decalcified portions traverse the bone substance in a stellated manner, the latter like hazel-nuts bordering the already decalcified zones (fig. 5). We see in other places (*cp.* fig. 6) the further progress of decalcification, the bone tissue being in atrophy or disintegrating to a very fine detritus. In still other places this detritus, which is apparently extremely capable of absorption, is already absorbed. The bone appears fissured, multiple cavities develop, the bone substance is perforated like a sponge, and the different cavities are traversed by stripes or bands of the hyaline substance, appearing hyaline, which are moreover in places studded by the above-described detritus or very finely granular masses. Preserved portions of bone extend in places into the defects like islands, the bone corpuscles of which are already in the state of degeneration (*cp.* fig. 6).

2.—*Influence of the Colloid Degeneration of the Endothelium of the Haversian Canals upon the Compact Osseous Tissue* (*cp.* Fig. 7).

This mode of the osseous change was frequently found. In the earliest beginning we see a few endothelia on the

inner wall of the small canals transformed into round or oval, homogeneous, colloid bodies, and the remaining endothelia are in fatty degeneration. In an apparently later stage the greatest part of the calibre is filled by colloid bodies, and the blood-vessel, with its contents, is pushed aside; in the last stage the entire contents of the Haversian canals consist of extremely swollen colloid bodies, nothing can be seen of the blood-vessel or of the blood-corpuscles, the Haversian canal is already enlarged in the shape of a spindle, and finally colloid degeneration extends to the bone, where at its transition the Haversian canal is enlarged like a flask. But, of course, this process causes nutritive disorders, the effect of which manifests itself in the territories of bone adjoining the colloid masses by their presenting an appearance of finely striated connective tissue, in which the bone-corpuscles look like spindles, or are entirely absent.

3.—*Influence of the Obliteration of the Haversian Canals upon the Medullary Substance.*

The medullary substance is subjected either to a more or less complete necrosis,[1] in which the medullary cavity may be found entirely empty, or its contents undergo colloid metamorphosis. In the less intense degree of the process the colloid bodies lie between the meshes of the reticulum of the connective tissue; in the extreme degrees the entire medullary substance is in colloid degeneration. The mechanical and initiative influence upon the bone tissue bordering the medullary cavities may then be identical with those described sub. 2.

f.—INFLUENCE OF THROMBOSIS AND OBLITERATION OF THE HAVERSIAN CANAL UPON THE DEVELOPMENT OF THE OSSEOUS TISSUE OF THE COCHLEAR CAPSULE.

As is well known, the cochlear capsule ossifies by the mediation of cartilage. We find, however, even in adults,

[1] The necrosis of the medullary substance may have a double cause: the obliteration of Haversian canals, and the influence of a micro-organism (in reference to this see the bacteriological part).

still in the midst of compact osseous tissue, remnants of non-ossified cartilaginous territories. The obliteration of the Haversian canal was not without influence upon some of these cartilaginous territories.

In a specimen, stained with picrocarmine, 2½ *mm* medially from the mucous membrane of the promontory, an *unstained* zone, 1 *mm* long and ½ *mm* wide, was found in the cochlear capsule, consisting of cartilaginous cells in fatty degeneration, or already in a state of granular disintegration, the whole limited by normal cartilaginous tissue; the Haversian canals entering the borders of these bright spots were thrombosed. In another place, into whose boundary the likewise changed Haversian canals entered, the cartilaginous cells had undergone the *colloid metamorphosis.*

g.—INFLUENCE OF THROMBOSIS UPON CHANGES WHICH HAD EXISTED IN THE PETROUS BONE PRIOR TO THE OCCURRENCE OF MEASLES.

The above described changes in the middle ear, the hyperplasia of the mucous membrane, and the catarrhal affection of the middle ear have, I believe, preceded the measles. The thromboses of the vessels of the mucous membrane of the labyrinthian wall were brought about by the transformation of the round cells of the mucous membrane into numerous granular cells and colloid bodies, and by the partial fatty degeneration of the stroma of the connective tissue, in consequence of which the mucous membrane offered a macroscopically noticeable areolar appearance. The *complete absence* of epithelium in this region might be attributed to the thrombosis.

h.—INFLUENCE OF THROMBOSIS UPON THE NERVES.

Condition of the Nerves in the Maculæ and Cristæ.

A change of the nerves was noticeable where they ascend to the epithelium—*i. e.*, upon the connective-tissue stratum of the maculæ and cristæ. Also here a great number of the nerve fibres were still normal. The changed ones

presented either *a lustrous yellow, gelatinous*, or a *peculiar homogeneous, fatty appearance*, with preserved medullary sheath and apparently normal width, but with fatty degenerated nuclei of Schwann's sheath and atrophy of its protoplasm. This is probably the first stage of the atrophy. We have at any rate before us a *pure primary nerve atrophy, due to thrombosis.*

Condition of the Nerves between the Lamellæ of the Lamina Spiralis Ossea at their Point of Entrance into and beyond Corti's Organ.

Between the lamellæ of the lamina ossea, as well upon the surface as at the bottom, a disintegration of nerves takes place; in consequence of absorption of the products of disintegration an extensive formation of defects between the still preserved nerve fibres appears in places irregularly arranged (*cp.* fig. 8), or the nerve appears normal up to the neighborhood of the point of entrance. Hereupon the products of disintegration infiltrate the beginning of the membrana basilaris, and render its structure indiscernible (*cp.* fig 9 at 1′). Beyond the point of entrance the atrophy is usually complete. Within Corti's tunnel we can no longer distinguish an indication of the nerve fibre, and neither of the spiral nerve fibres; the fibres supplying the inner hair-cells are disintegrated immediately after entrance (*cp.* fig. 10, 11 *a*, and 13, 13). In no place are granular cells apparent. Since I succeeded in proving the occurrence of micro-organisms in the products of disintegration of the nerves between the lamellæ of the lamina ossea, I would like to explain the occurrence of necrosis of the nerves in this region as due to two factors, viz., to thrombosis and to a direct action of the micro-organisms upon the nerves.

Specially Noteworthy Results of Examination.

In the following I shall endeavor to describe specially noteworthy results of the histological examination. A repetition will be unavoidable where we are dealing in the different regions of the labyrinth with a recurrence of identical

changes in addition to those specially noticeable. As regards this, I ask the reader's indulgence in advance. For all noted changes cannot be comprehended from a general point of view, as, *e.g.*, in the discussion of the influence of thromboses upon the varied tissues of the petrous bones. Moreover, we do not present a mere enumeration of curiosities, for under those conditions the entire discussion would be valueless, but a description of conditions, which are either of general pathological interest, or, possibly, apt to give some explanation upon, as yet, unsettled normal histological points.

The Hyaline Degeneration.

Fig. 3 gives an approximate picture of this change, which is extremely variable and multiform. I will try in the following to give a complete description of the changes in the remaining specimens, but I am compelled to acknowledge that it will hardly be possible to give a full and elaborate description.

The endolymphatic space, except about $\frac{1}{4}$ to $\frac{1}{6}$ of its lumen, is densely filled up to the region of the epithelial layer by coagulated and disintegrated lymph, which no longer contains any lymphoid corpuscles. The epithelial stratum is indistinct. The last fourth to sixth of the lumen is filled toward the point of insertion of the membranous canal partly by a group of non-nucleated lymphoid bodies, partly traversed by a reticulum of hyaline fibres, which are studded toward the inner cavity by a number of hyaline spherical bodies, and thereby communicate with the filling mass.

The epithelial layer is in some places entirely absent, and, where it is still preserved, the epithelial cells are highly granular, or their framework only is visible. In other sections the epithelial layer is replaced by spherical bodies arranged like stalactites. The propria itself is mostly covered by hyaline bodies and molecular detritus, and, where it is visible, it is without fibrillar structure; in some places it is perforated: in these places the hyaline structures of the endo- and peri-lymphatic cavities communicate.

In the *perilymphatic space* we see neither ligaments nor their endothelial cells, but the entire space traversed, here by delicate, there by wider, hyaline reticula; in the meshes of the reticula lie here structures like granular cells or irregular clusters of molecular detritus and finely granular masses; there numerous gelatinous spherical bodies, or cactus- or coral-like masses, which are also hyaline in character, are situated upon the margin of the reticula. The *vessels* of the perilymphatic space are thrombosed, their contents are in many places in the act of disintegration: The cellular elements of the wall are devoid of nuclei or entirely absent, whereby the external wall appears homogeneous and transparent. The entire outer wall of the vessels may also have undergone hyaline degeneration, and assumes a rosary-like appearance from hyaline bodies, cut longitudinally and adherent to the wall. The external walls of adjoining vessels are sometimes connected by a chain of hyaline spherical bodies.

Whence is the Material of the Hyaline Degeneration Derived?

In the endolymphatic space the cells of the epithelial layer and the lymphoid corpuscles furnish the material for it. The hyaline mass may, to be sure, disintegrate again; this is proven by the connection of hyaline bodies not as yet disintegrated with the products of disintegration (*cp.* fig. 3; endolymphatic space).

In the perilymphatic space the periosteum, the membranous bands, their endothelial cells, nuclei of the stratum of connective tissue, and the lymphoid cells take part in the process. But this material alone would not suffice in order to fill the entire space with hyaline masses and reticula. We should rather assume that the hyaline degeneration has been preceded by a gathering, a conflux of lymphoid corpuscles, which have become polynucleated cells before the degeneration has taken place. This hypothesis is supported by the fact that in the portions undergoing hyaline degeneration groups of polynucleated cells are found (*cp.* fig. 3, z). All structures in the perilymphatic space furnish, together with collected lymphoid resp. polynucleated cells, the

material for the hyaline degeneration. *The entire condition is an excellent illustration of cell decay or coagulation necrosis* (*Weigert*).

Genesis of the Hyaline Degeneration.

The hyaline degeneration may be effected by the thrombosis or by a direct influence of micro-organisms or by both causes simultaneously. On account of the special relations of the micro-organisms in the territory of the hyaline degeneration, I am inclined to *ascribe the principal part in its development to the micro-organisms.* I have in no place observed their extraordinary spreading to such an extent as in the two sagittal semicircular canals, *i. e.*, in the endo- as well as in the peri-lymphatic space. They are here found as well in hyaline reticula as also upon the periosteum undergoing hyaline degeneration, along which they immigrate up to the adjoining bone; they are also found upon and within the hyaline bodies, and in quite unusual numbers in the molecular detritus. The latter condition is not surprising, since *Manfredi* also has proven in his experiments that, wherever the necrosis due to micro-organisms is mostly developed, *i. e.*, in the centre of the nodules, the micrococci are found in largest numbers, furthermore that the micro-organism is by no means destroyed by this necrosis. According to *Manfredi's* beautiful experiments (*l. c.*, p. 725), "it appears that the persistence of its vitality in the masses of the necrosed tissue is to be ascribed to its capacity to live even in the dilutest media, and in those most inappropriate for its nutrition."

Horizontal Semicircular Canal of the Right Petrous Bone.

Its *endolymphatic space* is filled by fine molecular lymph detritus, enclosing here and there non-nucleated lymph cells. The configuration of its membranous wall is no longer elliptical but pear-shaped. The epithelial stratum is disintegrated. The membrana propria can hardly be recognized, and is chiefly covered by molecular detritus.

The blood-vessels of the *perilymphatic space* are extremely tortuous and thrombosed, the contents partly shrunken,

partly disintegrated; the connecting bands either swollen or atrophied; the cellular elements in retrogressive metamorphosis; the periosteum proper partly atrophied, partly unravelled; the configuration of the adjoining bones either convex or concave. At the turn of the lateral into the medial limb, extending two *mm*, the *perilymphatic* space is altered in the following manner: From the wall of the membranous semicircular canal, opposite to the place of attachment of the canal, up to the periosteum of the osseous canal the space is filled *mostly by newly formed osseous tissue.*

Horizontal Ampulla of the Right Petrous Bone.

The blood-vessels near the point of entrance of the nerves into the crista, those of the crista itself as well as those of the perilymphatic space, are thrombosed; the wall elements of the latter are in fatty degeneration, their contents partially disintegrated; the membranous bands atrophied, their endothelial cells disintegrated. In the endolymphatic space several scattered groups of *non-nucleated cells, by which the cupula terminalis is covered throughout, and the space between this and the ampullar roof is completely filled.*

First Cochlear Turn of the Left Petrous Bone.
(*Cp.* fig. 1, pl. i. and ii.)

About the lower half of the first turn both scalæ are filled, the scala tympani completely, the scala vestibuli partly, by stratified masses, which are contiguous to the endostal periosteum of the cochlear capsule, but not blended with the latter; but they are throughout rather distinctly limited by the sharp outline of the periosteum from the osseous tissue of the cochlear capsule. The longitudinal diameter of the filling mass in the scala tympani measures about 2 *mm;* the interspace between the filling mass in the scala vestibuli toward the modiolus about $\frac{1}{3}$ *mm;* toward the ligamentum spirale about $\frac{1}{4}$ *mm.* The boundary of the filling mass in the scala vestibuli is formed toward the ligamentum spirale by Reisner's membrane. This membrane is pressed into the ductus cochlearis, which is thereby stunted.

Reisner's membrane itself is extremely thickened, its epithelium is undergoing fatty degeneration. Toward the cochlear axis the peripheral zone of the filling mass in the scala tympani which, stained with picrocarmine, remains bright, consists of non-nucleated and disintegrated lymphoid cells. The remaining stratified masses in both scalæ present already osseous transformation (*cp.* fig. 2), and were stained red with picrocarmine.

This examination resulted, as was intimated above, in an ossification of both scalæ of the first cochlear turn, *wherein the endosteal periosteum was not at all implicated*, in contradistinction to the condition found in a case of acquired deaf-mutism in the same region, which I have described, together with Steinbrügge in a former vol. of these ARCHIVES (*cp.* the respective illustration). In this case both scalæ were traversed by newly formed connective tissue and osseous trabeculæ, *issuing from the endosteal periosteum of the cochlear capsule.*

I consider the sharp limitation between the osseous tissue and the periosteum in similar results of autopsies as a criterion for deciding the question, whether we have to deal with a congenital or an acquired ossification in the cochlear scala. Politzer, *e. g.*, demonstrated at the eighth meeting of South German and Swiss aurists in Vienna, April, 1887, ten specimens taken from an unpublished case of ossification of the cochlea, which Burckhard-Merian, in Bâle, had bequeathed to him. They were taken from a person thirty-six years old, admitted to an institution for deaf-mutes in his tenth year, but it was not known whether the disease was congenital or acquired. The cochlea, especially in the basal turn, was filled by osseous tissue, which was sharply differentiated in the specimen from the osseous cochlear capsule. According to this description I consider the condition as an acquired ossification, which may have developed from an ossification of gathered lymphoid cells in consequence of coagulation of lymph in the cochlear scalæ, produced by bacterial invasion after an infectious disease.

The changes in the territory of the cochlear canal are of a

double character. One series is *purely histological*, the other *purely mechanical*. The latter are the consequences of the former, for pathological processes resulting in atrophy or in formation of products of degeneration, produce a dislocation, a changed position either of entire parts of the organ or of their histological elements. Since in these dislocations the alteration of the ligamentum spirale takes a principal part, we shall place its description in the foreground.

The Changes of the Ligamentum Spirale.

(*Cp.* figs. 8 and 11, plates iii. and iv.)

In consequence of thrombosis of all its vessels the ligamentum spirale undergoes a nutritive disturbance of its histological elements, here to a slighter, there to a greater, extent. In the slighter degrees we have to deal with an equal atrophy of the cellular elements of all three layers, whereby the entire ligament assumes a brighter appearance. In the higher degree single layers, either the outer (fig. 11) or the middle, *disintegrate completely* with the formation of larger defects (*cp.* figs. 8 and 11) occasionally leaving behind products of disintegration, especially colloid bodies (fig. 8 at 3). The outer periosteal layer thereby loses, entirely or partially, its nuclei and its densely fibrous character, it becomes loosened or disintegrates completely, the adjoining bone becomes more like connective tissue or is transformed into osteoid tissue (*cp.* fig. 11). In the middle layer hyaline streaks are formed in places (fig. 11, h). The connection of the stria vascularis with the inner layer of the ligamentum spirale is loosened, or it is entirely detached (fig. 8), with the formation of a more or less wide defect. The epithelial cells[1] of the sulcus spiralis externus (fig. 8, 5 to 6) perish; they may be replaced by mono- or poly-nucleated cells (fig. 8, 5 to 6). This infiltration, as a rule, is in the region of the stria vascularis

[1] In very thin sections I found the epithelium of the ligamentum spirale situated above the prominentia spiralis still regularly arranged, but without nuclei.

wider, more abundant, and contains many cells, which have again lost their nuclei. In consequence of the described changes, the form of the entire ligamentum spirale is extremely altered. *Cp.* in reference to this the ligamentum spirale of fig. 8 with that of fig. 1.

Reisner's membrane (*cp.* fig. 8 and 9, plates iii. and iv.). The *histological alteration* of Reisner's membrane comprises all its elements; the membrane loses, by fatty degeneration, the endothelium of the vestibular surface as well as the epithelium of that facing the ductus cochlearis, and may finally appear structureless (fig. 9, 5). At the beginning of its origin on the vestibular side of the lamina spiralis ossea, and still some distance further upward and outward, the entire membrane shrinks by disintegration (fig. 8, at 9). In an entirely structureless condition the marginal portion may be covered by coagulated lymph or molecular products of disintegration (fig. 9, 6). Its surface is in other specimens covered by lymphoid cells (its outer two thirds in fig. 8, at 9), or by molecular detritus (inner third in fig. 8). There are sometimes on its margin hyaline bodies or clusters of either non-nucleated or nucleated lymphoid cells (fig. 8 in the middle third).

The *mechanical change* in Reisner's membrane is due to two factors: the first consists in the described dislodgment of the ligamentum spirale, its atrophy, and detachment of the stria vascularis from the underlying connective tissue; the second factor of the dislocation depends upon the atrophy of Reisner's membrane at its insertion upon the labium vestibulare of the lamina spiralis ossea.

The Changes of the Membrana Corti or Tectoria.

Everybody, even with a superficial knowledge of the topography of Corti's organ, inspecting the illustrations 8, 9, and 10, will be struck by the strikingly changed position of Corti's membrane. It is, as is well known, stretched above the sulcus spiralis internus, and extends to the outer hair cells beyond Corti's organ; it covers the latter, wherefrom the name "tectoria" is derived. In all

three illustrations no tectoria is really discernible; it lies at a great distance from Corti's organ above the sulc. spir. int. (fig. 9 and 10 or fig. 8), and is dislocated so far outward as to lie just above the crista spiralis.

We do not see its profile, as in other radial sections, but it is placed in such a manner as to present its entire lower surface (fig. 8, 13; fig. 9, 10; fig. 10, 8).

It is easy to discover that this *repeatedly* observed *condition* is not artificially produced.

The Changes of the Crista Spiralis.

If we view the figures 8, etc., we miss the concavity of the sulcus spiralis internus and the sharp-edged prominence of the labium vestibulare; the normally deep furrow is flattened, and the sharp-edged prominence of the labium vestibulare is represented by a blunt protuberance, apart from its infiltration with lymphoid cells. Embryological examinations prove (*Boettcher*, *Middendorp*, *cp. Schwalbe*, "Anatomy of the Ear," p. 356), that the acute angle of the labium vestibulare has as its precursor a slightly pronounced obtuse angle, which, however, assumes the definite form already during embryonic life. The illustrated morphological changes are possibly in connection with the tension and consequent detachment of the tectoria, which is intimately connected with the crista, and has been already discussed above.

The cells situated in the interdental sulci disintegrate, as also the epithelial cells upon the surface. The cells of the sulcus spiralis internus may be preserved; but they present a granular appearance (fig. 9 and 10), or they disintegrate partially (fig. 8 and 11); in this case they sometimes increase before disintegration and assume a darker shading, a granulation of the nucleus, which extends at the expense of the protoplasma of the cell-body close to the cell-wall (*cp.* fig 11). In this process of degeneration and disintegration also the labium tympanicum of the crista may take part, whereby it assumes a furrowed or fimbriated appearance (*cp.* fig. 10 and 11). The space of the sulcus spiralis

internus may at the same time remain free, or is more or less filled by lymphoid cells, or molecular products of disintegration (fig. 10). The latter are frequently superimposed upon the labium tympanicum, which thereby appears narrowed (fig. 8).

Changes of the Membrana Basilaris.

In vertical radial sections, as is well known, two strata of different structure are distinguished. The *upper* is a homogeneous continuation of the hyaline upper plate of the labium tympanicum ; it continues on the outer side into the hyaline lining of the sulcus spiralis internus. *Schwalbe* calls this layer the *membrana basilaris propria.* Upon the lower surface a tissue layer abundant in cells, the *tympanal lining stratum* (*Retzius*), is located as continuation of the lower lamella of the labium tympanicum.

The sharply pointed transition of the labium tympanicum into the basis substance of the membrana basilaris was lacking in several specimens. It can be distinctly recognized in fig. 9 and 11; it is not visible in fig. 8 and 11. in consequence of a deposition of products of disintegration of the adjoining nerve fibres. In some specimens the propria of the basilaris in its entire course up to the sulcus spiralis internus, where it continues as crista basilaris into the ligamentum spirale, is not visible on account of being infiltrated by lymphoid or polynucleated cells (*cp.* fig. 10). The same condition frequently existed in the nucleated hyaline layer situated upon the basilaris propria.

Mechanically, the outer portion of the basilar membrane is altered, inasmuch as in consequence of the atrophy of the adjoining ligamentum spirale it loses its tension, and instead of being horizontal, appears convex toward the vestibule. (*cp.* fig. 8 and 11).

The changes of Corti's organ are characterized by hyaline degeneration, partial or complete disintegration and atrophy of its cellular structures ; the nuclei remain longer preserved than the cell-body. A certain regularity in the succession of time of the disintegration can be distinctly recognized.

The inner epithelial cells perish earliest, followed by Corti's and Deiters' cells, then succeed Corti's arches, viz. the inner before the outer, and finally the lamina reticularis. The outer supporting cells resist longest, longer than Claudius' and Boettcher's cells. The various structures of Corti's organ still remaining, hereby frequently change their position, a dislodgment here in vertical, there in horizontal direction; the nuclei are dislocated to places where they do not exist under normal conditions. The appearance of the atrophy in the different specimens are extremely multiform and varying, and its condition found in all specimens can hardly be described in all its details. A number of them is represented in fig. 8 to 11 and their exact description can be found in the explanation of the illustrations. It is, however, necessary to discuss the question, whether we have really to deal with atrophic changes or artificial products respecting the action of reagents.

"In reference to the rods," *Boettcher* says, "when it was still disputed, whether they were easily destructible or very resistible structures, to whose substance Henle ascribed even a hardness approaching that of cartilage, I have pointed out their difference in fresh specimens from those prepared with muriatic or chromic acid. They obtain their great resistibility from the action of these acids and can then be easier studied in certain respects." Since our specimens have been decalcified with chromic acid, the objection, that the illustrated *anomalies of the connection* of the rods are artificial and not pathological, loses its force. I believe upon the whole, that it would lay the facts under restraint, if we consider the described changes of Corti's organ as due to the action of decalcifying fluids. These can by no means produce a complete atrophy of the inner supporting and hair cells. I do not hesitate to put the described changes in relation to the thromboses in the ligamentum spirale, especially to the described alteration of the stria vascularis.

"We believe," *Schwalbe* says, "to recognize in the stria vascularis the organ which serves for the secretion of lymph." ("Organ of Hearing," p. 353). If this is, as in our case (*cp.* fig. 8 and 11), destroyed or degenerated, there

results a fundamental condition for the alteration of the lymph and for nutritive derangement in Corti's organ with its sequelæ.

Applications of the Results of the Examinations to Controversies upon the Normal Histological Structure of Corti's Organ.

Boettcher in his above-mentioned "retrospects," etc., has added to his own observation a full criticism upon the most important, still pending controversies upon the structure of the cochlea.

It is not within the province of my subject to enter into a discussion upon these. I may have another opportunity to make use of my specimens with especial reference to this. I shall at any rate point out to experts, that specimens presenting atrophic processes in Corti's organs are especially appropriate to decide certain points of controversy.

With reference to two points in dispute I concur entirely with Boettcher: first, that Corti's organ presents a third zone, the so-called *marginal cord* (*cp.* fig. 9 and 10) and furthermore, *that Corti's cells show a basal process.* This latter condition can undoubtedly be recognized in various specimens of mine. It is distinctly illustrated in fig. 9 and especially at *c* in fig. 11.

II.—Bacteriological Part.

General Literature and History.

E. Klebs[1] raises, in his "General Pathology," on p. 336, the following question: Are there any processes which can with sufficient reason be considered as produced by coccacea, and which, on account of their peculiarities, form a group of the same category?

If we answer this question, we should, according to Klebs, first consider the *acute exanthemata*, which have always been comprised in one group, on account of important affinities in the manner of their extension and

[1] General Pathology or the Study of the Causes and the Nature of the Processes of Disease." First Part: The Causes of Disease; General Pathological Etiology. Jena, 1887.

transmission, as well as in their clinical symptoms. After an explicit explanation of this sentence, he continues as follows: "This typical course, which manifests itself here more distinctly than in any other infectious disease, has brought to light the homogeneousness of the forms of disease, when nobody dared to dream of their parasitary nature. Now we may confidently form the postulate, that all these forms of disease *are produced by microörganisms of similar character.* They all have in common the epithelium as a suitable nutrient soil, and cause from this focus those local and general symptoms in cyclical succession. According to our present, although incomplete, experience, it cannot be doubted that they may be classed among the coccacea. This is sure in *variola*, doubtful in *scarlatina* and *measles.*" Klebs has himself demonstrated that in variola the cocci show special arrangement, which he considers as an important characteristic, viz., the *arrangement in fours.*[1]

These *tetracocci* occur, besides isolated cocci, and those which lie together in irregular clusters, in the vaccine lymph as well as in the secretions of the mucous membranes of the pharynx and trachea in variola, and also in the vaccine lymph of man and cows. Cornil and Babés have also demonstrated the tetracocci in variola and in vaccine pustules.[2]

With regard to measles, full bacteriological examinations have been made of late by Cornil and Babés.

Cornil and Babés found in lungs affected with pneumonia, of patients who have died of measles, large numbers of diplococci, which, similar to the gonococci are composed, of two crescentic bodies, separated by a bright intermediary substance, form large zoöglœa masses or are arranged

[1] "In view of the wide distribution of tetracocci-forms, and especially in consideration of the fact that according to Bordone-Uffreduzzi, such forms are not missing among the microphytes found in the normal skin, the specific significance of the so-called tetracoccus variolæ (Klebs) seems to be quite doubtful," etc. "Text-book of Pathological Mycology," by P. Baumgarten. Second half, p. 389.

[2] With regard to the presence of micrococci in human variola, the first statements have been made, according to Klebs, by Luginbühl, who considered the giant cells, demonstrated by him in the first beginning of the pustule, as bearers of the virus.

in chains. Babés' cultures with blood from the exanthema of measles, and also products of inflammation of the lung, pleura, lymph-glands (upon human and bovine blood serum), resulted in the formation of streptococci. Their members were 8-shaped micrococci, but some were also found resembling streptococcus pyogenes. Subcutaneously injected into the skin of the nose of young guinea-pigs, they cause redness of skin, fever, and sero-purulent conjunctivitis, changes produced in the same manner by direct transmission of the blood of a child affected with measles. (*Cp.* Klebs, *l. c.*)

L. Manfredi has published of late a lengthy paper on the bacterium of measles.[1]

In two cases of pneumonia following morbilli, the sputa were shown to contain Friedlaender's pneumonia cocci upon plate cultures. Manfredi found an additional coccus pathogenic to animals, which produced, in experiments made upon animals, a new typical disease, which induced the author to name the respect. microörganism "the micrococcus of the progressive lymphoma or granuloma in the animal body."

The shape of this microörganism is oblong, with rounded or obtuse ends. They are found chiefly single or as diplococci, sometimes more as bacillar elements. They stain readily without characteristic features. After subcutaneous injection, multiple granular neoplasms develop in form of nodules in the inner organs. In the resp. tumors the cocci are found most numerous in the centre of the cells, less frequently outside the cells, rarely in the blood-vessels; they have, therefore, a chiefly intracellular action. The lymph-vessels are the path of infection.

Own Observations. General Remarks.

From the former description of the changes found in the petrous bones, the fact of their almost complete accordance becomes apparent, a fact of great importance for the sub-

[1] Ueber einen neuen Mikrokokkus als pathogenes Agens bei infectiösen Tumoren. Seine Beziehungen zur Pneumonie. (On a new micrococcus as pathogenic agent in infectious tumors, and its relations to pneumonia.) *Fortschritte der Medicin*, 1886, No. 22.

sequent remarks. The readers, nevertheless, will be surprised, some even disappointed, that I did not succeed in proving the existence of microörganisms in a decisive manner in the *different* parts of the tissues, except in one of the two petrous bones first examined, *i. e.*, in the left. In the right I could demonstrate[1] the resp. microörganism only in the medullary cavities and in the products of disintegration of the nerves between the strata of the lamina ossea. It would be wrong, however, hence to conclude that it had been the principal factor of the changes only in the *left* bone. If some bacteriologists admit that the occurrence of microörganisms is sometimes not easily proven, even in experiments made on animals, this holds good the more for the resp. examinations on pathological specimens, and especially for those on the human petrous bone, which must be decalcified for weeks before it can be cut and the sections be bacteriologically examined. And then the investigator must be so fortunate as to succeed in making very thin sections, else the bacteriological examination is not practicable.

In addition, it is difficult to demonstrate the microörganisms in the tissues, especially in some territories of the labyrinth we have to deal with very small numbers of microörganisms, or the changes are old. We find, as is well known, microörganisms sometimes only in freshly diseased parts, *e. g.*, in erysipelas (Koch, Fehleisen), or the difficulty of their demonstration lies in the microörganism itself, the life of which may be only of short duration, it may degenerate quickly, etc.

Methods of Examination.

The examinations were made on sections, viz.:

(*a*) According to Manfredi's method, *l. c.*, p. 724, weak watery solutions of methylene blue. The sections remain in it many hours (it is not stated how many), are washed afterward in distilled water and treated with alcohol. Then clearing up in turpentine oil and preserving in balsam.

[1] In the two petrous bones of the second case, disfigured in consequence of too extreme decalcification, I succeeded in proving the existence of microörganisms, in the medullary cavities and in the membranous semicircular canals in hyaline degeneration of one side.

(*b*) The well-known *Gram's method*, also recommended by Manfredi, had furnished me with beautiful results, which were more distinct than those obtained with the former, because the sections were better decolorized. The resp. sections, preserved in xylol Canada balsam, furnished lasting specimens.[1]

(*c*) According to Gabbett's method of staining tubercle bacilli.

Gabbett's method of staining tubercle bacilli in slide specimens is a slight modification of that of Neelsen.[2] The staining solution, which, according to Gabbett, is superior to all other aniline staining fluids, is prepared as follows :

Solution I.—One part magenta red (English name of fuchsin), 100 parts of water, 5 per cent. carbolic water, 10 parts of absol. alcohol.

Solution II.—100 parts of a 25-per-cent. solution of sulphuric acid, 1–2 parts (grammes) methylene blue (the solution must be of a dark-blue color).

For the preparation of slide specimens solution I. is slightly warmed in a watch-glass until vapors begin to rise. The slides prepared as usual swim *two minutes* upon it.

The treatment with acids and the contrasting after coloring is now combined cleverly *in one act* by the use of solution II.

The slide is washed off quickly in water after use of solution I. and placed in solution II. for one minute. It remains only to wash in water, to dry event., and to preserve in Canada balsam in order to finish the specimen.

So far H. S. Gabbett.

Dr. Ernst gives the following results :

(1) Slide specimens, as well as sections, are beautifully stained in solution I. (for two minutes), and solution II. (for one minute).

[1] " The microscopical examination of the micrococcus in tissue sections is different in some respects, which, I believe, should be ascribed to two reasons : First, that this micrococcus retains the aniline colors only slightly after a certain period of its existence ; we can, therefore, after staining of the sections, not determine beforehand the means of decoloration for the tissue, and we run the risk of decolorizing also the parasites. Secondly, that the mentioned microörganism, which is rarely arranged in zoögloea form, and, as a rule, rather attacks the protoplasm of the cells, whereby the nucleus is sacrificed by active segmentation and fragmentation, remains frequently exhausted in the midst of the not completely decolorized fragments of the nucleus."—Manfredi, *l. c.*

[2] *Cp.* according to Ernst, a review published in the *Medical Record*, July 9, 1887, concerning a note in No. 3,319 of the *Lancet*, April 9, 1887.

(2) It is unnecessary to *warm* the solution, a very desirable consideration for celloidin sections.

(3) Decolorization of the tissue and cells is complete to a degree never attained before, except by means of Futterer's modification (quite a tedious procedure); the contrast color thereby becomes much neater and cleaner.

(4) The staining fluids, as well as the colors in the Canada-balsam specimens (both in sections and in dry specimens), have remained unchanged in composition and intensity for three months.

(5) The single colored bacilli are brought out with great distinctness. The discovery of isolated bacilli, especially in the tissues, is extremely facilitated, probably because no red color whatever is left in the tissue.

From my own experience I can recommend this method as a very convenient and reliable one for sections of tissue containing cocci.

The form, arrangement, and size of the microörganisms, conditions and paths of invasion. (*Cp.* the colored plate.)

The microörganism in question should be ranked among the *coccacea.* It differs morphologically from that described by Manfredi by the constancy of the *round* form, *the spherical growth, while Manfredi describes his own as oblong, with rounded or obtuse ends;* the round form is constant, whether the parasite occurs as mono-, diplo-, and tetra-coccus (rarely[1]) in groups or irregular clusters, in chains or in strings. *The chain form* is, upon the whole, the *prevailing* one. The size of the single cocci varies, the larger ones being more numerous. If we place, morphologically, much value upon the chain formation, we should call this parasite also a streptococcus. *But it is very doubtful whether it may be considered as the specific microörganism of measles.* With reference to this point extensive investigations are necessary. I would like, however, to emphasize one point. In bacterial invasion of the labyrinth after diphtheria we have also to deal with a streptococcus and, as we know, with an *accidental and not with a specific microörganism* of diphtheria. But we know in this disease the conditions and paths of in-

[1] This rare occurrence as tetracoccus must be strongly emphasized with reference to the above-mentioned statement of *Kleb's* concerning the tetracoccus in variola.

vasion, to wit, loss of the epithelium of the mucous membrane of the pharynx and the air passages, penetration into the lymph-paths, chiefly after development of tissue necrosis in the pharynx and then from the lymph-paths into the blood. If we now suppose that the streptococcus found in measles in the labyrinth is identical with that in diphtheria, therefore but *an accidental and not a specific microörganism*, the condition should be considered a complication of this infectious disease (of measles), like in various other diseases which are associated with affections of mucous membranes, as in variola, typhoid and puerperal fever. *Lesions* of mucous membranes, however, are in measles less frequent and less marked than in the just-mentioned infectious diseases; acute forms of pharyngitis and tonsillitis occur, to be sure, but, as far as I know, no necrotic destructions. Thus it only remains to assume an immigration of the streptococci into the lymph-path and thence into the blood, by means of a lesion of the epithelium of the mucous membrane developed from the catarrhal affection of the pharynx, tonsils, and air passages. The conditions of invasion are, at any rate in measles, more unfavorable for the streptococcus than in the other infectious diseases; the danger of a bacterial invasion of the labyrinth in this infectious disease is, therefore, much smaller. Affections of the labyrinth in measles, are, in fact, rarely (*cp.* the clinical part) observed. In my practice, extending over almost 30 years, I met with only the two cases described in the clinical part. The possibility of a more frequent occurrence, however, in autopsies, is by no means hereby excluded. If we consider that, as far as I know, the labyrinth of persons who died of measles had never before been carefully examined, and that my examination is the first of the kind, it would be a strange coincidence if I should find this extremely rare exception in the very first examination.

Regionary Occurrence.

The efforts to discover the microörganism in the different parts of the petrous bone proved frequently fruitless, especially in the right petrous bone, in which I succeeded in

finding it only in the medullary spaces and in the products of disintegration of the nerves, between the strata of the lamina spiralis ossea. On the other hand I found it in the left petrous bone, not only in this, but also in the Haversian canals, in the endo- and peri-lymphatic cavity of the semicircular canals, and especially in the region of the hyaline degeneration, and here again in large masses in among the hyaline products of disintegration. Furthermore, it was seen in the periosteum in hyaline degeneration, and along this up into the necrosed osseous parts described above, especially in their sinuses. I could not prove in the above-mentioned territories their intracellular occurrence, except in the medullary cells. I could count them here up to six, arranged in chain-form at the periphery of the medullary cell, near the cellular wall. They could also be demonstrated within the colloid spherical bodies of the medullary cavity. The results of examination in the cochlea were negative.

Biological Properties of the Microörganism.

After it has been found impossible to distinguish *morphologically* the microörganism found in measles from that observed in diphtheria in the labyrinth, we will try to prove this *biologically*. This consideration appears the more urgent inasmuch as there exist, as is well known, five different kinds of streptococci, which cannot morphologically be distinguished from each other, but the pathogenic actions of which nevertheless differ in many respects. If we now compare the respective histological results of examination of the labyrinth in diphtheria with those obtained in measles, we record, above all, the important fact that we found *in the former signs of new-formation*, viz., small-celled infiltration, *e. g.*, in the Haversian canals and the medullary cavities, and hyperplasia of the periosteum in different regions, *e. g.*, in the semicircular canals, in the periosteum of the pyramid of the petrous bone, *as well as necrosis, e. g.*, of the bone and the medullary substance, *while the examinations in measles demonstrated nowhere signs of new-formation, but only those of necrosis.*

Our results of examination agree with those of Manfredi with regard to this pathogenic action. He says (*l. c.*) that the formation of micrococcus used in his experiments appears to be a production of *cell-necrosis*, by destroying the nucleus *within the cell itself* and the structure of the cell. The proof of the penetration into the interior of the cells was brought, at least undoubtedly in the medullary cells, and the signs of necrosis in the different regions of the petrous bone were plainly visible. *The necrosis cannot, indeed, be considered everywhere a direct intracellular effect of the microörganism, but it is frequently only an indirect one*, produced by the thromboses in consequence of the mycotic fatty degeneration of the endothelium.

Paths of Degeneration in the Labyrinth.

The demonstration of the microörganism within the Haversian canals and the endolymphatic cavity proves the existence of the respective parasite within the paths of the lymph and blood. The manner in which the immigration thence into the labyrinth takes place may be learned from my investigations on bacterial invasion of the labyrinth after diphtheria, which explain the different possibilities on the basis of the special anatomical and histological relations of the labyrinth, particularly as regards the connection of the endolymphatic and perilymphatic spaces with those of the cranial cavity.

Brief Review of the Genesis of all Discovered Changes.

I consider in measles, as well as in diphtheria, the coagulation of the lymph a *purely mechanical condition*, due to the immigration of the microörganism. The disintegration of the lymph elements in the endolymphatic space, which is without blood-vessels, may depend upon an intracellular action of the parasite, and may then be considered as a mycotic necrosis. Their disintegration in all tissues containing blood-vessels may be effected by the same cause or may be the consequence of the thromboses, or both. The thromboses are the consequences of a mycotic fatty degeneration of the endothelium. Their consequences have already

been explained. I would like to point out the fact that from the thromboses the numerous noteworthy changes in the region of the ductus cochlearis can be explained. How much here, chiefly in Corti's organ, is due to a *direct* influence of the microörganism, cannot be stated on account of the negative results of examination.

The biological action of the parasite takes probably a prominent part in the production of hyaline degeneration, and also in the disintegration of the nerves between the strata of the lamina spiralis ossea.

The necrotic degeneration, or the complete atrophy of the medullary substance of bone is probably the consequence of the obliteration of the Haversian canals and of a *direct* influence of the microörganism upon its tissue. Each factor may, moreover, produce the same result.

The vascular necrosis also may have this double cause. It may develop, as is well known, in continued thrombosis, since it affects the nutrition of the vascular wall itself, but it may be also the direct consequence of the mycotic action.

III.—Clinical Part.

From the appended literature a comparatively great infrequency of affections of the labyrinth in consequence of measles becomes apparent. They seem to be still less frequent than those in consequence of diphtheria. I have observed only two typical cases, whose full report is justified by the rareness of such observations. They are characterized, like those after diphtheria, *by permanent complete deafness, by disturbances of equilibrium, viz., staggering gait.* For the explanation of these symptoms, which are fully discussed in my paper on diphtheria, the pathologico-histological results of examination, in the labyrinth of persons who died from measles furnish sufficient points of support. I do not enter here, therefore, into an additional discussion of these conditions.

HISTORIES OF CASES.

First Case. Complete Loss of Hearing with Staggering Gait in the Course of Measles.

I am indebted to the kindness of Dr. Habermehl in Edesheim, Palatinate, for the notes of this case.

"The girl, five years of age, was seized February 12, 1885, with measles and attended for three days. Besides the usual symptoms, fever, inflammation of the organs of the chest, extensive exanthema, etc., *hardness of hearing developed from the beginning, which soon resulted in complete deafness.* Hoping that the hearing would be restored with the expiration of the disease, I delayed active treatment until March 1st. I then made instillation of astringents into the external meatus, to which Dr. Stempel in Neustadt added vesicants. The epidemic was extensive, and had upon the whole a favorable character, with a few sequelæ. This child *alone* was afflicted with deafness, which doubtless has not improved since in the least, and seems to depend on a nervous paralysis, since paralytic symptoms were manifested in the peripheral parts, as was noticed in walking. The child stumbled in walking, moved rapidly onward without being able to restrain herself. Further observations could not be made since I made three visits, and the child was brought to me three times. This is the way in country practice."

The examination, which I made May 4th, revealed a perforation of the posterior half of the right drum-membrane, without a trace of pus, either in the external meatus or in the remainder of the drum-membrane or beyond the perforation (confirmed condition !). The left drum-membrane was drawn inward and presented considerable dulness of the mucous membrane. *Absolute loss of hearing for all sounds. Marked waddling gait.* After seven unsuccessful injections of pilocarpine the mother withdrew the child from treatment, which Dr. Habermehl was requested to continue at home. I have heard no more about the further course, but I suppose the deafness remained unchanged.

Second Case. Complete Loss of the Faculty of Hearing with Remaining Staggering Gait after Measles.

M. St., girl, twelve years of age, presented herself at the aural clinic for the first time May 30, 1885.

The mother states that the girl was five weeks previously seized with fever and intense headache, followed after a week by measles, from which recovery took place without particular complications. In the second week of the disease "the hearing was quickly lost, vertigo developed, and in the third week staggering gait when leaving the bed."

The examination revealed shortening of the cone of light on

either side and dulness of the mucous membrane of the drum-head. The patient is absolutely deaf and staggers still considerably. After twelve injections of pilocarpine, which proved entirely unsuccessful, the patient withdrew from treatment.

Review of Both Cases.

With the exception of the perforation of the right drum-membrane in the first case, which perhaps developed before the attack of measles, both cases present a complete agreement of symptoms—*absolute deafness and disturbance of equilibrium, viz., staggering gait.* Both cases can be explained by means of the above-described changes of the labyrinth, to the details of which I now merely refer. The *changes in the semicircular canals, or in the ampullæ* respectively, must probably be considered the anatomical causes of the disturbances of equilibrium. The deafness could be due to *hemorrhages* into the larger nerve bundles, to destruction of the nerves, and a great number of nerve fibres, furthermore to filling of the cochlear scalæ in consequence of stratified apposition of lymph cells with their consecutive changes, and finally to the fully described changes in the terminal apparatus, among which the colloid degeneration and the atrophy of Corti's organ rank first. I need hardly point out that no treatment can influence such changes, as its failure indicated in both cases. The number of my observations, however, is too small to conclude from them that the prognosis is unfavorable in all cases of nervous deafness after measles. They belong at all events to the severest forms of nervous diseases of the ear.

F. Rohrer's remarkable observation is a proof[1] that the prognosis need not always be absolutely unfavorable.

A girl, twelve years of age, was suddenly affected with complete deafness in both ears, a week after the eruption of measles. Beginning and course of the disease did not present any extraordinary features. Subjective noises on both sides, here and there with transition into distinct musical tones; staggering gait is not recorded. The examination of the history had to be made in writing on account of the complete deafness. Absolute loss of

[1] A case of sudden deafness after measles. *Correspondenzbl. f. Schweizer Ærzte*, vol. xiv., 1889.

hearing for all sounds, even for bone-conduction. Negative result of examination; slight swelling of Eustachian tube. Deafness lasting twenty-five days. Return of the faculty of hearing after headache of two days' duration, peculiar disturbances of vision, and psychical and nervous attacks; sulkiness, melancholia, fixed look, sluggish reaction of pupils, and a series of eclamptiform attacks.

Besides a central lesion, Rohrer says in the review of the remarkable case, there existed undoubtedly a certain connection of the affection with the measles and an affection of the tube and the middle ear. A diminution of the hearing power was probably thereby started. The subsequent absolute deafness, connected with profound disturbances of the nerve functions in general and of the acoustic nerves in particular, might have been produced by central changes and lesions. Hyperæmia of the labyrinth and a neuritic irritation of the acoustic from the middle ear may occur. Rohrer mentions here the immigration of coryza bacteria (Klebs) through the frontal and ethmoidal sinuses, and also through the tympanic cavity, whereby cerebral hyperæmia, especially of the base and œdematous swelling of the arachnoidal tissue and of isolated nerve sheaths may be produced. These serous infiltrations at the basis cerebri, Rohrer thinks, are under these circumstances easily produced; *transitory* severe meningeal symptoms, principally in children, may not infrequently be diagnosticated as consequence of these occurrences. One might at all events take exception to the hypothesis of the genesis of the complete deafness on account of hyperæmia and irritation of the acoustic, because these changes hardly produce absolute deafness. It may be perhaps more fully explained by the supposition of a hemorrhagic exudation at the acoustic, absorbed again in the course of weeks. The remarkable concomitant cerebral symptoms, which were associated with the return of the hearing-power, render, moreover, this case unprecedented.

Synoposis of the Literature on Measles as Cause of Aural Diseases.

1. I. Toynbee, "Diseases of the Ear," mentions—in chapter xv., under section 3—hardness of hearing produced by the action of

morbific poisons on the nervous apparatus of the ear, besides gout, typhoid fever, scarlatina, and mumps, also the measles.

2. On aural diseases as consequence and cause of general diseases. Inaugural Dissertation, by Joh. Heydloff, Halle, 1876. Measles in relation to scarlatina are considered as comparatively benign with regard to aural affections.

3. I. Gottstein. Contributions to aural affections developing in the course of acute exanthemata. *Arch. f. Ohrenheilk.*, vol. xvii., p. 16, etc. Among 1,193 aural patients treated by Gottstein in three years, 66 cases, or 5.5 per cent. were due to scarlatina, measles, and variola. G. describes here fully a case of acute desquamative inflammation of the drum-membrane in the course of measles, combined with perforative, purulent inflammation of the middle ear, recovery; and an additional case of throat diphtheria and *otitis diphtheritica* sinistra in the *second week of measles*, also with recovery.

4. L. Blau. On aural affections occurring in acute infectious diseases. *Deutsche med. Wochenschr.*, 1881, No. 3. According to Blau, aural diseases, following measles, principally the purulent ones, may take a very severe course.

5. L. Blau. Diphtheritic inflammation of the external meatus after morbilli, followed after eleven days by diphtheritis faucium. *Berliner klin. Wochenschr.*, 1884, vol. xxi., p. 33.

6. Contributions to the statistics of aural diseases, by Dr. K. Bürkner. *Arch. f. Ohrenheilk.*, 1884, vol. xx., p. 81. We read on page 85: "Measles seem more seldom to cause aural affections. Of all patients, 3.0 per cent. ascribed their aural affections to morbilli, according to Kramer; 2.3 per cent. according to Schmalz; 2.7 per cent. according to Harrison; 1.5 per cent. according to Wilde; 0.1 resp. 0.4 according to Zaufal, and 3.2 per cent. according to *my* notes (epidemic of measles in Göttingen, winter 1881–1882)."

7. A. Tobeitz. Morbilli: clinical and pathologico-histological studies. *Arch. f. Kinderheilk.*, vol. viii., p. 321. Otitis media was the most frequent complication, 16 times among 73 convalescents. From the anatomical examinations of the hearing organ of the fatal cases there results, with all probability, a greater frequency of diseases of the ear. Of 22 children who died, the tympanic cavity was found, on examination, diseased in 17 cases. redness and swelling of the mucous membrane, destruction to the bone, obstruction with muco-purulent or putrid masses,

Clinical symptoms of disease were manifest in only 7 among these 17 cases. Tobeitz found in two, deceased on the first and third days, resp. after the appearance of the exanthema of measles, this otitis bilateralis also at the autopsy. Tobeitz supposes, therefore, that the middle ear, as well as the conjunctiva and the respiratory organs are *independently* affected in measles, but the affection may, clinically, not become evident before the stage of inflammation. The exudation of the, always lobular, pneumonia of measles is cellular, and tending to necrosis. The micrococci discovered in this affection are not concerned in the process of measles as such.

Literature Concerning Measles as an Etiological Factor of Acquired Deaf-Mutism.

1. "Diseases of the Ear," by I. M. Itard, German translation, 1822, p. 445, chapter xviii. On deafness by metastasis. Itard considers measles the disease which most frequently destroys the hearing by metastasis.

2. F. L. Meissner, "Deaf-Mutism and Instruction of Deaf-Mutes," Leipzig and Heidelberg, 1856, says, on page 158: "Extensive experience leads us to agree with Itard."

3. "Extension of Blindness, Deaf-Mutism, Idiocy, and Insanity in Bavaria," etc., by Dr. G. Mayr. No. 35 of the contributions to the statistics of the Kingdom of Bavaria, Munich, 1877. No. 42: In the year 1840 there were in Bavaria, among 2,897 deaf-mutes, 22, and in the year 1858, 3, in consequence of *variola and measles.*

4. A. Hartmann, "Deaf-mutism and Instruction of Deaf-Mutes," Stuttgart, 1880, mentions in table xii., p. 76, among 832 cases of acquired deaf-mutism, 30 in consequence of measles.

5. According to A. Hedinger, "The Deaf-Mutes and the Institutions for Deaf-Mutes in Württemberg and Baden," there was among 207 cases of acquired deaf-mutism in the two institutions of Baden, one case, or 0.48 per cent. after measles.

6. Schwabach. Deaf-mutism. S. Eulenburg's "Real-Encyclopædie." He mentions the rare occurrence of measles as cause of acquired deaf-mutism.

7. H. Schwartze, "Diseases of the Ear," Stuttgart, 1885, mentions, on p. 368, "larger blood extravasations into the labyrinthian cavity and into the membranous labyrinth," also in measles.

The statistics collected from the above-mentioned literature, except those of Tobeitz, indicate a comparative rareness of aural diseases in general after measles and of severe labyrinthian affections in particular. These statistical results offer a kind of consolation for the severity of the changes produced by the virus of measles in the labyrinth.

Explanation of the Illustrations.

Fig. 1 (Plates I. and II.).

Part of a radial section through the first cochlear turn and the neighboring region of the modiolus of the left petrous bone. That portion of the section is represented which lies nearest to the cochlear root. Hartnack, 22, tubus o.

We see in the modiolus portion, as far as possible to the left and below, two tortuous, dull and thickened fragments of the arter. auditor. intern. = g, partly limited by an upward concave line, an indication of a perineurium, which had become structureless = s p. Further upward a rust-colored hemorrhagic exudation in process of pigment metamorphosis.

g sp = ganglion spirale.

s t = scala tympani.

s v = scala vestibuli.

l sp = ligamentum spirale.

st v = stria vascularis.

v d c = stunted ductus cochlearis.

p = a bright, periosteal stratum of delicate fibre on the medial wall of the scala tympani with a vascular defect ; p′ = the same with two thrombosed vessels.

Both scalæ are filled, the scala tympani completely, the scala vestibuli partly, by a mass consisting mostly of lymphoid cells in osseous transition, the smallest portion of broken-down lymphoid cells without nuclei ; this area appears bright in specimens stained with picrocarmine, the remainder, which is in osseous transition, and which is represented by the portion designated by $\frac{1}{8}$ in fig. 2 (plates I. and II.) appears red.

The ossified masses are in contact with the periosteum of the cavities in question, but not blended with them. It is clear that a proliferation of the periosteum must be excluded. It is easy to discover that a filling of the scalæ was gradually brought about by a *stratiform apposition* of the cell masses. The sulcus spiralis

internus is filled by a mass, not morphologically discernible, and forms a connected and compressed whole with the papilla acustica, the membrana tectoria, and the region of Claudius' cells.

Fig. 3 (*Plates I. and II.*).

Transverse section through the membranous and osseous semicircular canal and the neighboring bone. Hartnack $\frac{3}{5}$, tubus o.

K = bone.
E = endolymphatic.
P = perilymphatic cavity.
h-h = membranous semicircular canal.
p = periosteum.
g = thrombosed vessels.
g^1 = thrombosed vessel with hyaline thickening of the wall.
z = group of cells with one and more nuclei.
P^1 = perilymphatic cavity with hyaline degeneration of reticular structure.

The outline of the osseous and membranous semicircular canal, which in the normal state is sharply defined as well as their elliptical form, is lost. The structure of the osseous frame of the semicircular canal is indistinct in parts, the periosteum partly unravelled, partly atrophic (*cp.* the periosteal lining at P^1). The endolymphatic cavity is almost entirely filled, chiefly by a homogeneous mass of detritus, with which (on the right of the drawing) a number of spherical hyaline structures are connected.

The epithelial layer of the membranous canal is lost; it is entirely lacking; the propria (in the upper half of the drawing) may only be in part plainly distinguished. The connective-tissue layer, the membranous bands and their endothelial cells, form with each other and with the mostly swollen periosteum, a coherent structure of a partly reticular, partly cactus- and grape-like hyaline mass. The blood-vessels are thrombosed at g^1 with marked hyaline thickening of the wall. At z a group of mono- and poly-nucleated cells is seen. The region indicated by two lines < is represented in the following figure with higher power.

Fig. 4 (*Plates I. and II.*).

Hartnack $\frac{8}{5}$, tubus o.

In this enlarged representation the grape-like form of the hyaline degeneration is plainer, the condition of the hyaline masses, which are again partly molecularly disintegrated, more coarsely

granular on the left and below the blood-vessel, which is traversed by the section, and whose wall is considerably thickened, more delicately granular below the longitudinal section of the blood-vessel.

In the latter is specially noteworthy (1) the condition of the *wall*. Its bright appearance is interrupted by dark long and short lines, apparently still the indications of the cellular elements in hyaline transition. And (2) the contents. The blood-corpuscles are irregular and mostly polygonal in consequence of the formerly existing globar stasis.

Fig. 5 (*Plates I. and II.*).

Part of a *vertical section* through the right cochlear capsule. The drawing is taken from a spot situated 1 *mm* medially from the mucous membrane of the promontory. Hartnack $\frac{8}{9}$, tubus o. Specimen stained with picrocarmine.

The specimens represent the initial and final stage of the change in the bone due to obliteration of the Haversian canals. The initial stage is represented in the lower $\frac{1}{4}$ of the drawing. The irregular appearance of the bright spots in the lower $\frac{1}{4}$ is caused by the basis-substance in the act of decalcification, which remained unstained by picrocarmine. The osseous areas lined by them, in which the bone corpuscles have partly lost their processes, were stained pale-red with picrocarmine. The upper $\frac{1}{4}$ represent, as far as they are characterized in the centre by large lacunæ, the final stage of the bony change due to obliteration of the Haversian canals. One part of the basis-substance of bone is still preserved in form of bridges and strips, which are covered in part by products of disintegration ; another abounds in the shape of arch-like lines, which are connected with each other by small and large bright spaces.

These are complete osseous lacunæ, originating from the breaking down of the osseous tissue into detritus, with subsequent absorption. The Haversian canals (on the left of the illustration) contain only thready fibrin, and present a streaked appearance ; another canal (on the lower right) shows shrinking of the contents besides the striated appearance.

The osseous tissue, situated on the right and left from the above-described upper $\frac{1}{4}$, shows pale-red coloration, finely fibred appearance, partly with stunted and partly without any bone corpuscles ; the same holds good for the immediate neigh-

borhood of the obliterated Haversian canals. The Haversian canals on the left remained colorless, but every thing else showed yellow picrin staining, as represented in the illustration.

Fig. 6 (Plates I. and II.).

Part of a *horizontal section* through the right cochlear capsule. The drawing is taken from a place in the bone, which is situated 2 *mm* laterally from the inner cavity of the second cochlear turn. Hartnack $\frac{3}{7}$, tubus No. o. Glycerine specimen.

The changes represented in the drawing are, on the whole, the same as those presented above as the final stage of the upper $\frac{1}{2}$ in fig. 5, on the longitudinal section, only differing in their being extended over a larger territory. Besides the numerous interspaces due to the destruction of the bone tissue, there is seen in the centre of the drawing a still preserved oval island of bone, with bone corpuscles without processes, surrounded partly by decalcified basis-substance, partly (on the left and below the bone-island) by an interspace. Both Haversian canals (on the right of the illustration) are thrombosed. The preserved osseous stroma is chiefly covered by a finely grained, homogeneous detritus, or the meshes produced by it enclose these fine masses of detritus.

Fig. 7 (Plates III. and IV.).

From a transverse section of the capitulum stapedis of the right temporal bone. Hartnack $\frac{3}{7}$, tube drawn out.

H K = Haversian canals.

bk and bk′ = remnants of parietal blood corpuscles.

As far as H K extends the calibre of the Haversian canals is unchanged ; in consequence of the stasis, the blood-corpuscles are mostly polygonal. The greatest part of the Haversian canals is considerably enlarged by partly roundish, partly oval colloid bodies. Remnants of blood-corpuscles are seen only at isolated points of the space, whose walls are enlarged and from which the epithelium is absent. The epithelium also is wanting throughout the whole length of the lower wall, between bk and bk′.

Fig. 8 (Plates III. and IV.).

From a radial section through the second cochlear turn and the adjoining cochlear capsule. Hartnack $\frac{3}{7}$, tubus o.

1. Osseous cochlear capsule. 2. External or periosteal layer of the ligam. spirale. 3. Region of the middle or loose layer

(atrophied). 4. Inner layer, g = thrombosed vessels. 5. Transparent substance of the crista basilaris, which, at 6, goes almost at right angles into the membr. basilaris instead of a concave curvature, as in the normal state, while the mb. is curved instead of horizontal. Claudius' and Boettcher's cells are missing in this region. In their place products of disintegration are seen. Between 5 and 6 the cells of the sulcus spiralis externus are also wanting. Instead of these mono- and poly-nucleated cells are seen. 8. Region of the stria vascularis. 9. Reisner's membrane. 9′. Its insertion to the detached ligam. spirale. 9″. Reisner's membrane atrophied at its insertion. 10. The radial and medullated nerve-fibres between the layers of the lamina spiralis ossea. The numerous regularly recurring light spaces are due to lost nerve-fibres. Cr. = Crista spiralis. 11. Its labium vestibulare is infiltrated with lymphoid cells. This infiltration continues to 9″ and 15, beyond the margin of the crista spiralis. 12. Labium tympanicum of the crista. This presents chiefly a homogeneous appearance, in smaller portions a striated one, except at its inner portion, where (to the right of 9″) on the upper surface of the nerve extension a few spindle-like, radially arranged nuclei of the periosteal layer of the crista may be seen. 13. Membr. Corti, or tectoria, is visible *en face* and dislocated. The tectoria is chiefly blended with Reisner's membrane ; the blended portions are concavo-convex. 14. Marginal cord of the tectoria covered by mono- and poly-nucleated cells and products of detritus. 15. Its inner fixed insertion in the act of disintegration. 16. Sulcus spiralis internus ; its epithelium partly in the act of disintegration, partly wanting. The transparent substance of the labium tympanicum of the crista (12) in the act of disintegration, narrowed, and its surface furrowed, instead of being smooth ; under the surface products of disintegration, partially covering the initial portion of the basilaris, hence its transition into the latter is indistinct. The nucleated layer of the basilaris devoid of nuclei, the initial portion of the latter is striated. The tympanal lining stratum (*th.*) of the basilaris apparently widened. This is due to an infiltration of non-nuclear as well as mono- and poly-nucleated cells, which extends into the area of the nerve on its lower surface (near 12). 17. Inner, 18. Outer rods of Corti's arches. 19. Outer supporting cells.

With regard to the characteristic change of the ligamentum spirale, we are best instructed by the large crescentic, almost

entirely empty space (3), in the lower portion of which a large colloid body is situated, which has been forced arch-like into the corresponding portion of the ligamentum spirale (in the normal state it is concave towards the scala vestibuli). The falciform space represents the so-called *middle loosened layer* (3) of the ligamentum spirale (Schwalbe) perished by tissue disintegration, whose ultimate product is the hyaline body. The *outer*, in the normal state, dense, periosteal layer (3) is preserved, but loosened and has mostly lost its former abundance of nuclei. The adjoining bone is also changed (*cp.*, the text). The right lower five oval spaces are veins with shrunken contents. The left thrombosed vessel, situated to the left and somewhat below the colloid body, is a vein. Downward and inward from this we see an atrophic portion, which, as well as the thrombosed vein, *belongs to the inner and, normally, dense layer* (4) *of the ligamentum spirale.* This third wide layer of the ligamentum spirale, which normally consists of densified connective tissue, abundant in cells, has a brighter appearance than in the normal condition, on account of one portion of the still preserved cells being devoid of nuclei, another being entirely destroyed. The extreme stage of atrophy is found below the colloid body, upon its inner and lower portion (*cp.* the text above).

Upon the inner surface of the inner layer of the ligamentum spirale, facing the sulcus spiralis externus, upward from the insertion of the basilar membrane, we see the translucent limiting membrane (5) in connection with the basilaris, forming its modified continuation. It is studded with a number of mono- and poly-nucleated lymphoid cells, which have partly lost their nuclei. Their epithelium is wanting; it is lost. Where it ends the considerably changed stria vascularis (5) begins. This, in the normal state intimately connected with the inner layer of the ligamentum spirale, has become detached from it by the pathological process; the point of detachment is indicated by an arch-like interspace, expanding upward to the insertion of Reisner's membrane (*g'*). Reisner's membrane is hereby already lowered at its insertion and its angle of insertion, outer-upper or vestibular angle, becomes obtuse, while in the normal state this does not occur below the third turn. Partly in consequence of this detachment, partly through the morphological change, the shape of the ligamentum spirale in the entire region of the scala vestibuli is changed beyond recognition. In the normal state[1] concave from the

[1] *Cp.* Fig. 1.

insertion of Reisner's membrane to the prominentia spiralis, on this place convex, further downward again concave, and throughout with a sharp edge, the big difference is well marked, notably by the absence of the prominentia spiralis and its vessel. The blood-vessels of the ligament are obliterated. Instead of the ligament we see an irregular layer of mono- and poly-nucleated cells, which are devoid of nuclei.

Corti's organ is considerably changed. Upon the membrana reticularis, to the end of the outer supporting cells, we see, partly, a number of hyaline bodies whose walls are already in the act of granular disintegration, partly fine detritus and coagulated lymph. The inner supporting (the hair) and the epithelial cells, situated inward and below these, are wanting. Instead of these we see detritus, a few mono- and poly-nucleated cells, the largest ones being outward from the body of the inner rod.

The nerve-fibres passing in- and outward from the inner rod of Corti's arch to Corti's organ, are absent. The configuration of Corti's tunnel (between 17 and 18) is irregular, in consequence of the altered curvature of the arch, especially the inner one. The basal cell of the outer rod, as well as the protoplasmatic layer, are wanting.

Specially noteworthy is the change in the region of the outer supporting cells. The membrana reticularis extends only to the fourth last outer supporting cell. The second last is already atrophied ; its dislodged nucleus lies next to the third last. The limiting walls also of the the four last supporting cells are already in the act of atrophy, and their fine products of disintegration are confluent with those of Claudius' cells. The basal portions of Deiters' cells are partly in hyaline degeneration, partly atrophied. Of their phalangeal processes the process of the second and fourth cells is the most plainly visible. The atrophy of the hair-cells is further advanced than that of Deiters' cells. We see the remnants of the first and fourth hair-cell adhering as hyaline bodies to the membrana reticularis.

Fig. 9 (*Plates V. and VI.*).

From a radial section of the second cochlear turn of the right petrous bone. Hartnack $\frac{3}{8}$, tubus drawn out.

1. Radial medullary nerve-fibres. 2. Crista spiralis. Its surface, instead of being slightly convex, is irregularly convexo-concave, studded with mono- and poly-nucleated cells. This in-

filtration continues into the sulcus spiralis internus. The transparent layer, the vitreus of the crista, is dull. The processes of the stellate bodies of the propria are absent. The propria and the periosteal layer form a stratum, interlaced by radially arranged nuclei, upon whose surface up to the neighborhood of the labium vestibulare (3) lies a cylindrical epithelium, the outlines of which upon the inner half of the row of cells are irregular and indistinct on account of beginning disintegration. 3. Its labium vestibulare is stunted (*cp.* text). 4. Its labium tympanicum, between both the sulcus spiralis internus, is flattened, instead of being concave. 5. Reisner's membrane. 6. Transition of the labium tympanicum into the basilar membrane. 7. Nuclear layer of the basilar membrane. 8. The so-called tympanal lining stratum infiltrated by mono- and poly-nucleated cells. 9. Epithelium of the sulcus spiralis internus, partly extremely granular. 10. Corti's membrane, with its marginal cord. 11. Inner; 12. Outer Corti's rod. 13. Outer supporting cells. 14. Remnants of atrophied Corti's cells. 15. Atrophied basal pieces of Deiters' cells, compressed by a transversely oval, hyaline structure. 16. The epithelium of Reisner's membrane (5) is wanting; it is mostly covered by products of retrogressive metamorphosis; between its inner portion, which is here abnormally convexo-concave, and the centre of Corti's membrane, or m. tectoria (10), coagulated lymph is found; the tectoria is detached from Corti's organ and placed upon its surface. *All structures of Corti's organ, situated in front of the inner Corti's rods, are completely destroyed, viz., the inner supporting cells, also the nerves running to the inner auditory cells, the inner auditory cells themselves, and the epithelial cells (Retzius), situated inward and below the auditory cells.* Instead of these we see between 4 and 11 a group of polynucleated cells, lying outward and somewhat upward from 11 upon the inner arch, two oval, hyaline structures (possibly products of degeneration of the inner hair cells), the latter surrounded partly by some polynucleated cells, partly by coagulated lymph, which covers and encloses the entire remaining Corti's organ.

Of both Corti's arches, only the outer one shows fibrillar structure, the inner only upon the upper portion, the basal portion being homogeneous. The outer basilar portion is lacking. We see Corti's tunnel, filled by an oval structure, and enclosed by an anchor-like, dark, homogeneous mass, partly contiguous to the inner rod, and by a bright, hyaline mass, which embraces the

inner surface of the outer rods. Of the phalangeal processes of Deiters' cells, we see only two distinctly, viz., the first and the last, but all their basal portions, stunted, and approximated by a large, transverse, oval structure, situated between the last Deiters' and the first outer supporting cell.

We see three stunted hair-cells without hairs, two of which, the two first, have distinct processes directed towards the basilaris.

The structure of the outer supporting cells still appears normal, except the indented condition of their boundaries, directed toward the ductus cochlearis, which in the normal state is convex.

Fig. 10 (*Plates V. and VI.*).

An additional radial section from the second cochlear turn of the right petrous bone. Hartnack $\frac{3}{8}$, tubus drawn out.

1. Radial medullary nerve-fibres at 1′ disintegrated. 2. Crista spiralis, almost entirely covered, *i. e.*, the inner half by nucleated, and its outer half by cells without nuclei, and by products of disintegration. 3. Its stunted labiumve stibulare. 4. Its labium tympanicum. The transition into the basilar membrane hidden by overlying products of disintegration of the nerve and invisible. The surface of the labium tympanicum is partially disintegrated, thereby presenting a fimbriated appearance. 5. Nuclear layer of the basilaris partially covered by products of disintegration. 6. Basilaris propria, only its outer half visible. 7. The so-called tympanal lining stratum infiltrated by mono- and poly-nucleated cells. The infiltration partly extends into the membrana basilaris, which, therefore, appears indistinct. 8. Corti's membrane with its marginal cord. 9. The flattened sulcus spiralis internus with its epithelium, upon which products of disintegration are situated. 10. Region of the inner rod. 11. Outer rod. 12. Outer supporting cells. 13. Disintegrated nerve running to the inner portion of Corti's organ. The structures of Corti's organ, situated in front of the inner rod, are entirely missing, as in fig. 9. Instead of the inner rod (10) we see a pear-shaped hyaline structure partly covered by an oval, dark, nucleated cell, the nucleus itself being highly granular. The body of the inner rod is missing; only its head-piece is seen. In the corresponding interspace we see a large and next to it a smaller hyaline structure, both surrounded below by an isolated cell, above by a group of polynucleated cells, the entire territory in question being outwardly limited by molecular detritus.

The outer rod (11) has lost its delicate, dark, longitudinal striæ partly upon the basilar portion, its head-piece, as well as that of the inner rod, being more striated than in the normal state. The protoplasmatic lining and the basilar cells of both rods are absent. Instead of these we see Corti's tunnel chiefly filled by a round and hat-like hyaline structure, the latter with two nuclei. The cell upon the outer rod (11) is perhaps the outer basilar cell, which has advanced further upward. The entire condition probably represents a product of metamorphosis of the basilar cells and of the protoplasmatic lining of the rods. The group of cells between 4 and 13 is a remnant of the perished portion of Corti's organ, situated in front of the inner rod. Nerves are not seen to enter Corti's tunnel. Three stunted hair-cells (14) are seen, all without processes, and just as many changed Deiters' cells.

Of the Deiters' cells (15) the first is blended with the first hair-cell, both are stunted, the last, the fourth Deiters' cell being the least stunted. It represents a concavo-convex arch, apparently interrupted by an overlying cellular structure, which can be traced to the neighborhood of the basis. The basal portion of the first Deiters' cell is in hyaline degeneration, between which and the basal end of the last an irregular dull granular mass is situated. The Claudius' and Boettcher's cell are absent. The entire Corti's organ is enclosed partly by coagulated lymph, partly by molecular detritus.

Fig. 11 (*Plates V. and VI.*).

Radial sections through the second cochlear turn of the *left* petrous bone. Hartnack $\frac{3}{4}$, tubus O.

1. Bone. 2. Inner or periosteal stratum of the lig. spirale, loosened at 2′, inwardly a hyaline band; downward from 2 at 2″ we still see the nuclei of the periosteal layer, in the remaining portions to the parts below more or less large defects, due to tissue disintegration. This is also true of the middle and inner layers in the upper portion, and of the middle layer in the lower portion of the drawing. g = thrombosed vessels. 3. Transparent substance, continuation of the propria of the basilaris. 4. Region of the prominentia spiralis in the act of atrophy and disintegration with a thrombosed vessel, downward a group of lymphoid cells, which further downward are lying upon the transparent substance (3) of the basilaris. In the direction of the outer supporting cells the basilaris shows indications of the disintegrated Claudius'

cells. 5. The tympanal lining stratum, infiltrated by lymphoid cells, up to the radial medullary nerve-fibres. The layer which lies nearer the labium tympanicum is brighter, and in the act of atrophy. 6. Radial medullary nerve-fibres, their entrance into the epithelium (*a*) atrophic; beyond their entrance, granular products of disintegration. 7. Labium tympanicum of the crista spiralis. 8. Its transition into the basilaris. 9. Region of the sulcus spiralis internus; the inwardly situated epithelial cells partly spherical, in beginning disintegration, instead of low, as in the outward portion. 10. Region of the inner supporting and hair-cells, which are lacking. In their place upward some detritus. 11. Inner Corti's arch defective. 12. Outer Corti's arch. Its body proper separated from the head and basilar portion, and somewhat dislocated with the separated ends. Basilar cells and protoplasmatic layer of both rods absent. 13. Nuclear layer of the basilaris, covered by products of disintegration; these products partly cover the adjoining propria of the basilaris. 14. Outer supporting cells, their outer wall partly covered by polynucleated cells. The protoplasma of the four outer supporting cells is homogeneous, and brighter than that of the remaining portion. The greatest portion of Corti's and Deiters' cells is atrophied. Of Deiters' cells, the last (*d*) is preserved best. *We emphasize that the process of one Corti's cell*, the cellular body of which is in hyaline degeneration, *is still preserved running towards the basilaris*. The inner portion of the membrana reticularis is absent.

Explanation of the Colored Plate (*Tab. VII.*).

Fig. A.—From the perilymphatic space of the sagittal membranous semicircular canal of the left petrous bone. From a visual field of the hyaline degeneration, with partial disintegration of the hyaline masses. *Hartnack.* Oil immersion $\frac{8}{12}$. Tubus 0, 650:1. We see chiefly mono- and strepto-cocci, now and then also irregularly arranged groups and clusters of cocci.

Fig. B.—From a medullary cavity of the left petrous bone. *Hartnack.* Oil immersion $\frac{4}{12}$. Tubus 0, 1000:1. We see chiefly mono- and diplo-cocci, isolated chains, and clusters of cocci. The medullary substance was partially destroyed, therefore a portion of the medullary cavity empty.

Fig. C.—From a Haversian canal of the left petrous bone. *Hartnack.* Oil immersion $\frac{4}{12}$. Tubus 0. 1000:1. We see mono- and isolated tetra-cocci; but the chain-form is, upon the whole, prevalent.

Fig. D.—From a Haversian canal of the right petrous bone. *Hartnack.* Oil immersion $\frac{4}{12}$. Tubus 0, 1000:1. All forms mentioned before are also represented, but in smaller number.

REVIEWS.

The Surgical Treatment of Brain Diseases. Prof. E. VON BERGMANN, Berlin.

The range of operative surgery grows ever wider. A technique steadily improving, conjoined with rigorous antisepsis, leads continually to fresh triumphs. A successful nephrectomy is no longer a rarity.[1] Langenbuch[2] has done a partial extirpation of the liver with good results, and Victor Horsley has led the van in the surgical treatment of tumors of the spinal medulla, with the brilliant removal of a myxoma which had, for three years, occasioned the most severe symptoms.

The surgical treatment of brain diseases has a longer history, thanks not only to the advances in surgery proper, but also to the untiring researches of the physiologists and brain-pathologists, in connection with the localization of function.

Among the affections which are accessible to surgical interference, and which have been repeatedly operated with success, belong cerebral abscesses due to otitis. The first case of this kind operated and cured was by Schede, and was reported by Truckenbrod in these ARCHIVES, vol. xv., p. 170.

At the international otological congress held at Brussels in 1888, Thomas Barr reported six such cases, with a permanent favorable result in five. Von Bergmann,[3] in his model essay on brain surgery, had already, in the early part of 1887, developed the subject of the operative treatment of these affections.

It would be a grave sin of omission were we to content our-

[1] Schede has obtained eleven cures in twenty cases operated by him. *Deutsche med. Wochenschr.*, 1888, No. 52.

[2] *Berliner klin. Wochenschr.*, 1888, No. 3.

[3] Arbeiten aus der chirurgischen Klinik der Königl. Universität Berlin. Herausgegeben von E. v. Bergmann. V. Die chirurgische Behandlung von Hirnkrankheiten, S. 50–164.

selves here with a passing reference to this most important work, especially as far as it deals with the treatment of ear diseases. A somewhat extensive review of it, however, will not render it less necessary for my colleagues to make a careful study of the work itself; to read it merely were not enough. It may happen to any aurist, even though his practice be limited, to have the question presented to him whether the aid of a competent surgeon may not help him to save the life of a patient. The study of the essay and the review will be of considerable assistance in deciding the important points presented in such a case.

In many cases, indeed, his conscience will remain troubled until his surgical colleague has answered "Yes" or "No" to the question of the advisability of operative interference. Bergmann speaks thus: "It is just in this district of brain surgery that it has happened to me more than once that very able colleagues have invited me to perform operations which I felt obliged to refuse. Such differences have suggested to me the advisability of bringing about a better understanding between physician and surgeon by a presentation of the attitude which surgery, according to my view, must take with regard to a certain class of brain diseases. One can well understand how, in these considerations, I think primarily of the interest of the surgeon. My personal tendency, or, rather, my conviction, inclines me to narrow rather than extend the range of surgery. Nowadays we are apt to dare every thing without reflecting as to the aim and reward of the venture. I think that I am not limiting too much the proper field of surgery if, in the accompanying clinical studies, I first investigate the conditions under which surgical interference has good, or I will even say the best, chances of success, and then recommend operation for such cases, and such only."

My colleagues who have had experience with abscesses of the brain, following ear disease, and are familiar with their clinical signs, course, and pathological appearances, will agree with me that the principle laid down by our eminent surgeon is the only reliable one. One needs but to recall the cases he has seen run a typical course, and contrast them with those others in which post-mortem examination reveals multiple abscesses; or, again, those in which several possible etiological factors are presented in connection with a doubtful disease-picture.[1]

[1] For example, in one case to which I was called, traumatism, syphilis, and a recently cured otorrhœa, entered into the question of the etiology of the disease. —*Reviewer.*

Deep abscess of the brain. As suppuration of the brain can terminate only in rupture into the ventricles, or the equally fatal diffuse meningitis, the opening of an abscess of the brain must be regarded as a means of relief from a most threatening danger to life. As to doubting the necessity of trepanning for brain abscess on account of the possibility of its encapsulation (lately Rose), or because of the attending difficulties of diagnosis, the author says: "The range of the first is overestimated, the difficulties of the diagnosis are gradually being overcome."

Only such brain abscesses as develop rapidly are found without a capsule, *i. e.*, a sclerotic thickening of the surrounding tissues. *Brain abscesses which have developed gradually and slowly are almost all encapsulated.*[1] This capsule does not represent the limit of the suppurative process, and does not protect the brain tissue from extension of the process. Post-mortem examination often shows breaks in the capsule; we can not regard the process, therefore, as an efficient limitation leading to a sort of cure in the way of retrograde changes. The hope that a collection of pus in the brain, if left to itself, may spontaneously find an exit through the ethmoid plate into the nasal passages, or through the roof of the tympanum into the ear, and, that so, a favorable termination may ensue, is not to be entertained. A fortunate issue can be expected only from the use of the trephine, to which the difficulties of diagnosis offer no longer the same insuperable objections, as heretofore.

In this connection the etiology is the main factor. Brain abscesses do not occur idopathically. They arise either from a traumatism or from a suppurative process in the skull, most frequently an otorrhœa. There are, however, metastatic and tuberculous cerebral abscesses; the former are merely incidental to pyæmia, and are therefore multiple. Exceptionally we find them single; they are so much easier to diagnosticate, as they are connected with the presence of pus collections in other organs.

From the opening of tubercular abscesses of the brain little is

[1] The question as to the shortest time in which encapsulation may take place, a question very important also in its medico-legal bearings, is, unfortunately, not yet settled. In a case of left-sided chronic suppuration of the middle ear, to which I was called a few hours before the fatal termination, the patient had been confined to bed only eight days, with severe pains in the ear and head. Symptoms of earlier cerebral trouble were denied both by the relatives and the two physicians in attendance. Autopsy: A carious spot, of the size of a pin-head, in the roof of the tympanum over the malleo-incudal articulation, basilar meningitis, and *two abscesses already encapsulated*, one in the left half of the cerebrum, the other in the right half of the cerebellum.—*Reviewer.*

to be expected. *A favorable issue is to be looked for only in cases caused by traumatism, or by suppuration of the ear or other bony parts. An early diagnosis in such cases is therefore of importance.* We must pass by without special notice that part of the work devoted to abscesses arising from traumatism. Our main interest is naturally centred in those connected with otitis. They constitute probably one half of all abscesses of the brain; this lacks, as yet, statistical proof. The suppurative process is always chronic (no brain abscess has ever been found connected with acute purulent otitis); its seat is the middle ear. It is generally the product of an otitis media chronica purulenta originating in youth.

The abscesses are seldom found immediately above the diseased tympanum; indeed, the greater number are separated by a layer of normal brain substance from the site of the primary suppuration.

"*The position of the deep abscesses under consideration is quite definite. With few exceptions, they are found either in the temporal lobe or in a cerebellar hemisphere.* The former situation is more common than the latter."

The author cites the following statistics of Barr. Of 76 cases of suppuration of the ear (7 of them coming under Barr's personal observation), the abscess was situated in 55 in the temporal lobe, in 13 in the cerebellum, in 2 in the pons, and in 1 in the crus cerebri. No statements are made with regard to the encapsulation of these abscesses, nor of the presence of sinus-thrombosis or meningitis as complications.[1] In 69 cases the pus was fetid.

[1] The Reviewer takes the liberty of inserting the following statistics of Körner, collected, indeed, with an entirely different object in view, that of proving and explaining the greater prevalence on the left side of diseases originating in middle-ear affections and caries of the petrous bone. Sixty-seven abscesses of the brain arising from otitis are divided into 5 groups. There are 31 abscesses of the cerebrum, 19 of the cerebellum, 4 of cerebrum and cerebellum, 8 of cerebrum with phlebo-thrombosis of the transverse sinus, 5 of cerebellum with phlebo-thrombosis of the lateral sinus. In 14 of the cases of cerebral abscess the temporal lobe was exclusively affected; with the temporal lobe affected there was involvement of the frontal lobe in 1 case, of the posterior corner of the opposite side in 1 case, of the occipital lobe in 1 case, and a complicating meningitis in 8 cases, in 1 of which the abscess was double.

The corpus stratum and thalamus opticus were the seat of the disease once, the right hemisphere twice, the parietal lobe once, the base of the posterior lobe once, the medullary substance of the first upper frontal and of the anterior central convolution. A comparison of the statistics of Barr and Körner shows the following difference. According to Barr the abscess is located in the temporal lobe in 72.3 % of the cases; according to Körner, if we disregarded complications, in 37.3 %, but if we include only uncomplicated cases, and none others should be submitted to operation, only 20.9 %. It would carry us too far to submit the other tables to a like analysis. This single comparison suffices to show that the pure cases are rarer than would seem from Barr's statistics, and that great caution must be exercised on account of complications and the multiplicity of the abscesses. (*Vid. Arch. f. Ohrenh.*, vol. xxvii., p. 126–139.)

"Abscesses of the brain begin insidiously, and herein lies the difficulty of the diagnosis." The author denies[1] that slight concussions, or other injuries of the head occurring in the course of ear disease, can lead to the formation of brain abscesses, because, in the cases in which death has followed such traumatism, the interval was too short and the abscess too large; more rapid growth, rupture, etc., of the abscess under these conditions, have been demonstrated. "I have twice had occasion, in the practice of otologists, to observe the rapid development of the abscess from the latent condition to the final stage, after trepanation of the mastoid" (!).

Suppuration with and without ostitis in other parts of the skull play only a very unimportant part in the history of brain abscesses. Whatever be their origin, we may divide them, according to the symptoms they produce, into three groups:

1. Symptoms, directly dependent on the suppuration.

2. Symptoms of increased intracranial pressure and of disturbing displacements of the brain substance (showing partial resemblance to those of tumors of the brain).

3. Focal symptoms corresponding to the site of the abscess.

In the diagnosis of otitic brain abscess, we can place no reliance on the sudden accessions of fever (chills and rise of temperature), which in cases of the traumatic form correspond with the periodical development of the chronic abscess,[2] because the suppurative process in the ear may produce like symptoms, as in retention of pus, etc. No greater reliance can be placed on disturbances of the general health.

One of the earliest and almost constant symptoms dependent on suppuration of the brain is *the pain in the head, caused by the increased intra-cranial pressure, and regularly becoming more intense during the febrile exacerbations.* It is often a fixed pain; in otitic abscesses of the temporal lobes or cerebellum strictly localized, corresponding to the situation of the abscess, and increased by percussion of the painful spot.[3] The other pressure-signs are, the terminal stage not being considered, rarely so well developed as in brain tumors. In the latter they are rather constant, in abscess

[1] In opposition to Griesinger.—*Reviewer.*

[2] In a very interesting case of traumatic abscess, under the care of Bergmann the temperature was one degree higher on the corresponding side of the head than on the other. The thermometer of v. Anrep was employed in making the measurements.

[3] The pain is increased by all movements of the head, including such as are communicated to it by coughing, or even hawking.—*Reviewer.*

they vary more. Slowing of the pulse—even to 30,—loss of consciousness, coma, may all intermit in abscess, the intermissions naturally being deceptive; in tumor such intermissions are very rare. On the other hand, the choked disc is much more common in the latter.[1]

The focal symptoms are of considerable importance when the abscess is situated in the motor region, but of very little value when in the frontal, occipital, or temporal lobes. For as long as the suppuration is confined to the medullary layer and the gray substance is preserved, the focal symptoms may be absent, even though the entire half of the cerebrum be involved; the more the abscess invades the cortex, the more definite do they become.

In considering the advantages to be obtained from the evacuation of a brain abscess, it is of considerable prognostic value that the focal symptoms dependent on destruction of the brain substance will persist after the operation, whilst the circulatory disturbances in the neighborhood of the abscess and the symptoms resulting therefrom admit of recovery.

The author does not enter upon the discussion of the special focal symptoms and their important combinations. He holds that when the abscess is situated in the frontal lobe, it affords no clue for a diagnosis, as the entire lobe may be destroyed without special sign. "The nearer the abscess approaches the posterior division of the frontal convolution, the more apt are we to observe strabismus, disturbances of speech, and irritation or paralysis of the facial. Abscesses of the occipital and temporal lobes are characterized by the same absence of focal symptoms. Hemianopia, the characteristic focal symptom of the occipital lobe, was noted in a single case of abscess situated in this part. If ever, in a case of unilateral suppuration of the ear, deafness should develop in the opposite side without any peripheral disturbance of the hearing, and if at the same time there are symptoms which point to the existence of an abscess in the temporal lobe of the side first affected, the newly developing deafness may be regarded as a decisive focal symptom, as the physiologists locate the centre of hearing for each ear in the opposite temporal lobe.

The author reports only successful cases from his own practice

[1] We learn, however, from the reports of the cases given, that in large abscesses where the pressure on the cranial contents is considerable, the choked disc is present, and may be a very useful diagnostic symptom. The greatest difference in pulse rate has been observed, by the Reviewer, in a case examined immediately before and after rupture of the abscess into the ventricles. The pulse fell suddenly from 132 to 36; death ensued in a few minutes.

and that of others during the past few years (in the *Deutsche med. Wochenschr.*, 1888, No. 50, he has reported an otitic brain-abscess successfully operated more recently); he discusses in this connection, among other things, the observations of Schede-Truckenbrod on aphasia as a focal symptom in affections of the temporal lobe, and claims for them a certain importance.[1]

Bergmann recommends, as the best spot for trepanation with the chisel, "a region somewhat in front of and above the posterior angle of the parietal bone." The middle temporal convolution may be reached without injury to any of the main branches of the middle meningeal, if we enter at a point found by producing a line passing through the lower edge of the orbit and the auditory meatus 4 *cm* behind the latter, and erecting here a perpendicular 4–5 *cm* long. Syringing of the abscess after opening is disapproved of. Simple evacuation of the pus is sufficient. To determine the location of the pus the exploring needle must replace the knife. *It is not a matter of moment, under all circumstances, to discover every abscess that may possibly exist in the hemispheres of cerebrum and cerebellum, but rather to make sure of opening that of which clinical experience has enabled us to recognize the presence.*

If otologists, in connection with competent surgeons, will but act on this principle, we will be justified in expecting, in the course of time, fairly favorable statistics on operated otitic brain-abscesses. However, disappointments will be in wait for even the most cautious and skilful surgeon, as, for example, in those cases of multiple abscesses in which one runs a typical course, the other or others remaining latent. It must always be borne in mind that the carriers of infection,[2] which we may now regard as the mediate cause of the abscess formation, *wander simultaneously into various districts of the brain*, in any of which they are liable to

[1] I was once called by two colleagues to see a patient, himself a physician, shortly before his death, in order to determine if the brain affection had any connection with the ear disease. The patient had been from youth subject to an occasional left-sided otorrhœa. After a period of excitement and sleeplessness lasting eight days, he suddenly developed an ataxic aphasia in the midst of his professional duties. There could be no doubt of the connection between the ear disease and the abscess of the temporal lobe. The aphasia may be intermittent in cases where the course of abscess of the temporal lobe is very protracted. Such a case is described in Toynbee's work. Intermittent aphasia occurs further as an indirect focal symptom in tubercular meningitis of the convexity. When it is accompanied with fixed pain in the temporal region, as I once observed it, and that, too, almost immediately following the healing of a left-side suppuration of the middle ear, it may easily lead to error in diagnosis.

[2] In two cases observed and studied by me I found bacilli and enormous masses of micrococci, but no streptococci in the abscess-membrane.

settle and develop. This wandering, according to Binswanger, occurs most probably through the lymphatic canals of the connective tissue, and explains the fact which pathologists and otologists have long since known and wondered at, that abscesses of the brain, as a rule, are separated by a more or less wide zone of healthy brain substance from the original foci of inflammation in the ear, and that further, a second collection of pus is not infrequently found in the opposite half of the brain. (*Reviewer.*)

TUMORS OF THE BRAIN.

"If a brain-tumor is to be operated, it is not enough to know the position of the growth; it must be ascertained also if the tumor admits of enucleation."

Basing his conclusions on the statistics of one hundred tumors of the brain, collected by White, Bergmann shows in how small a proportion of the cases the operation is indicated. The results in the cases thus far operated, in all eight, are accordingly poor. In five, death ensued as a result of the operation; in but one, Horsley's, has a permanent cure (reported four months later) been obtained. An exploratory trepanation is absolutely contra-indicated when a positive diagnosis of the locality of the tumor cannot be made from the focal symptoms. Hemorrhage and œdema of the brain are serious dangers which may result from the operative interference. (Compare the reports of the cases.)

EPILEPSY.

The traumatic epilepsy developing after head injuries is to be regarded as a cortical epilepsy after Jackson. In considering their treatment it is well to study their analogy with those produced experimentally by irritation of the parts of the brain-cortex presiding over motion. Horsley deserves also here the credit of leading the way. Two cases operated by him may be regarded as cured.[1] He holds that all the parts that look diseased must be removed. The operation for epilepsy is allowable and indicated "when we have full reason to believe in the presence of a palpable and removable lesion of the brain-cortex. This we have, however, only in such cases in which the convulsive movements begin, advance, and finally become generalized in exactly the same way as in the experimentally produced cases in the animal."

[1] Very recently, Keen, of Philadelphia, has operated successfully three cases of traumatic epilepsy. They proved to be tumors of traumatic origin. Comp. *Deutsche med. Ztg.*, 1888, No. 87.—*Reviewer.*

We have endeavored, so far as space permitted, to present to our readers the essence of this most valuable work. The nicer details and practical hints are to be found mainly in the clear and brilliant comments added to the elaborate case-reports, and to these we would again bespeak special attention.

S. Moos.

2. **The Ear and its Diseases** (being practical contributions to the study of otology). By SAMUEL SEXTON. Edited by C. J. Colles, M.D. New York: W. Wood & Co., 1888. Price, $4.00.

Sexton's well gotten-up book of 461 pages, is a semi-systematic treatise of otology, treating at exhaustive length subjects to which the author has devoted special attention, whereas others are very cursorily dealt with. In fact, the bulk of the book consists of the republication of papers, here and there somewhat changed, which the author has contributed to various periodicals during the last fifteen years. There is a good deal of suggestive original matter in the book, at the side of not a little of a dogmatic and speculative character, setting boldly the authority of the writer against the authority of all the world. In some subjects the mental idiosyncrasy of the author is apparent,—for instance, in the ubiquitous dental reflex and a leaning towards specific medication.

While reading the book we jotted down a number of remarks which we thought would interest our readers.

The improvement of hearing and relief from autophony and nervous symptoms which many patients experience in pulling the auricle in various directions, are explained by the change of tension of the drum-head by the exterior muscles and fascia of the ear. In an anatomical specimen prepared by the author and Dr. S. H. Pinkerton, alternate tension and relaxation of the fascia, tightened and relaxed the *Mt*, the motions being perceptible to the eye (pp. 21 and 22). Chapter III., "The Aëration of the Tympanum," contains many quotations from, and Chapter IV., "The Sense of Hearing," draws extensively on, a paper by Dr. W. Rutherford (published in *The Lancet*, 1887). Helmholtz's theory of sound-perception must be abandoned in favor of W. Rutherford's telephone theory of sound-perception which the author adopts. "This theory is that the cochlea does not act on the principle of sympathetic vibrations, but that the hair-cells vibrate to every tone just as the drum of the ear does; that there is no analysis of complex vibrations in the cochlea or else-

where . . . ; that the hair-cells transform sound-vibrations into nerve-vibrations which, arriving in the sensory cells of the brain, there do not produce sound again, but the sensations of sound, the nature of which depends not upon the stimulation of different sensory cells, but on the frequency, amplitude, and form of the vibrations coming into the cells, probably through all the fibres of the auditory nerve."—(pp. 56, and 57.) "Should my theory of the sense of hearing find acceptance, it will lead to a reconstitution of the theories regarding the other sense organs." This theory, by which it would be difficult to explain diplacusis and other phenomena, will be completely demolished when microscopic studies continue as they have begun to demonstrate that tone defects in the field of audition depend on the destruction of certain portions of the cochlea, as defects in the field of vision are shown to depend on the destruction of certain portions of the retina. There is no need, as yet, to reconsider the theories of the other sense organs.

In Chapter V., "The Common Causes of Ear Disease" are rather scantily treated. Some of the causes are not even mentioned,—for instance, the characteristic and most important deafness from hereditary syphilis, the occurrence of which, in conjunction with heredito-specific (parenchymatous) keratitis, is by no means rare. In Chapter VI., to make amends, the causes of catarrh of the upper air tract are discussed at great length, especially the meteorological influences.

The reflex influence of oral irritation is detailed in Chapter VII., and passes as a red thread through the whole work. To define his position in this respect, the author says: "That all morbid conditions of the mouth may exist without serious or recognizable aural affection cannot be denied (p. 97). . . . In his aural practice he has observed a great many recoveries quickly following the removal of defective teeth" (p. 96). Granting the correctness of the author's assurance, I expect reciprocity of belief on his part when I sum up my personal experience as follows: I have seen cases, a good many of them—some even from the author's practice—in which the removal of the incriminated teeth showed no influence whatever on the ear trouble.

Chapter VIII., Sea-bathing, etc. Nothing new.

Othæmatoma (Chapter IX.) is very extensively described, though the author, in conformity with earlier writers, makes no distinction between it and the simple—non-hemorrhagic and

non-traumatic—perichondritis. He recommends not to be too hasty in interfering, as a certain number of cases tend to spontaneous recovery. Pressure has proved unsatisfactory, in his experience. With proper discrimination he recommends massage, a silk seton, scraping of the walls of the tumor, and otoplastic operations. The latter can be performed with considerable freedom. The author's pet remedies, aconite in mild cases, and calcium sulphide "where suppurative processes arise" are, of course, not left without a good word.

The remainder of Chapter IX., twenty-two pages, gives a careful compilation of cases of gun-shot and sabre wounds of the ear, abstracted from "The Medical and Surgical History of Our Civil War," and from different American and foreign sources. They will be read with interest and prove useful for reference. In the author's own case (p. 169) an attempt at removal, under narcosis, of a bullet from the tympanum was unsuccessful. The patient was told to return, but failed to do so. Chapter X., "Injuries of the Drum-head and Drum of the Ear," is very instructive. Ruptures of the *Mt* from all possible causes, especially from explosions, are very fully discussed, and illustrated by drawings and the history of numerous cases. Chapters XI., "Anatomy," and XII., "Catarrhal Inflammation of the Middle Ear," are short, presenting nothing new.

Chapter XIII. is very readable, containing a number of suggestive remarks and some very instructive cases. It is strange, however, that the author continues denouncing the operations of opening the mastoid process. The almost universal approbation of this procedure has wrung from him the concession of its admissibility under certain conditions, but it seems that in all his 30,000 cases of ear disease he has never seen fit to perform it, his "success in affording drainage through the tympanum having deterred him as yet from the latter procedure" (p. 284). This procedure does not seem to us so strongly supported by his statement that fourteen of his cases of *acute* suppurative otitis have died (p. 274). In acute cases, where not only life but also good hearing can be preserved, where, through swelling of the soft parts in the drum cavity and ear canal, the secretion is stowed in the adjacent pneumatic cavities, seeking an outlet at the point of least resistance, which in a number of cases is the cranial cavity, it is easier, more efficient, more conservative, and safer to establish an outlet through the outer table of the mastoid process than

through the delicate and most important structures in and around the tympanic cavity. Moreover, the opening in the mastoid can readily be kept open until the inflammation has disappeared, whereas an incision through the soft parts surrounding the drum cavity is apt soon to close again.

The chapter on "Aural Polypi" is short and to the point. The Reviewer would only add that absolute alcohol, as recommended by Politzer, is useful not only after operations, but causes many young polypi to shrink and disappear; besides, it makes the operation of larger ones easier by lessening their bulk and contracting the swollen adjacent tissues. The Reviewer would further like to say that it is advisable, after each polypus operation, carefully to examine the base of the polypus, for recurrent polypi always spring from a carious or necrosed bone which ought to be scraped with a sharp spoon, and, if loose, removed with a pair of forceps.

Among the subsequent chapters, "Facial Paralysis," "Anomalies of Audition," "Aural Phenomena and Brain Affections," Chapter XVII., "Excision of the Drum-head and Ossicles," is the most important. It gives as well a conscientious appreciation of what, in this field, has been done by others (Schwartze, Kessel, Lucæ) as a detailed description of the author's views and experience, with a tabulated report of twenty-nine cases.

Part Fourth concludes the book with the following miscellaneous articles: The education of school children with defective hearing; the effect of high atmospheric pressure on the ear in tunnels, caissons, etc.; damage by unskilful attempts at removal of foreign bodies; claims of soldiers for pensions. H. KNAPP.

3. **A Manual of Diseases of the Ear.** By ALBERT H. BUCK. For the use of Students and Practitioners of Medicine. 419 pages. New York, W. Wood & Co., 1889. Price, $2.00.

Dr. Buck's manual may be considered a second, revised edition of his text-book, which, under the title "Diagnosis and Treatment of Ear Diseases," appeared in 1880 in "Wood's Library of Standard Medical Authors," where it was carefully withheld from the aural specialist. The present work, though bearing the original stamp of the author, is less personal than the former. The general descriptions are more systematic and concise, with a fair presentation of the views held by other, especially American, writers. The rules for diagnosis and treatment, as far as we can judge, are practical, trustworthy, and up to the times. We

think, however, that the author has clogged his text with the histories of too many cases from his practice. These histories may interest the specialist, but the "busy practitioner" and the busier student will read with attention only the general description of a disease and seek their personal experience rather in the clinics and their daily rounds than in the case-books of other physicians. Apart from that we may fairly say, that among the galaxy of text-books on the ear Dr. Buck's treatise holds an honorable position.

H. KNAPP.

MISCELLANEOUS NOTES.

On the occasion of the World's Fair this summer, an International Congress of Otology and Laryngology will be held in the Palais du Trocadéro, in Paris, from the 16th to the 21st of September. Committee of Organization: Prof. Duplay, President; Dr. Gougenheim and Ladreit de Lacharrière, Vice-Presidents; Dr. Löwenberg, Secretary.

The American Medical Association will meet this year at Newport, R. I., on the 25th of June, for a four days' session. The sections of ophthalmology and otology promise to be well attended.

Fig. 1.

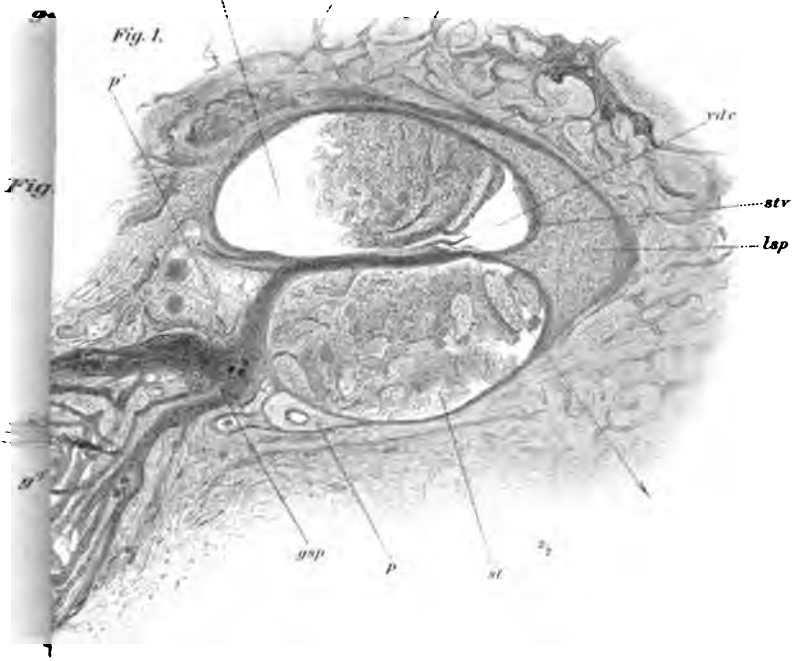


Fig. 4.

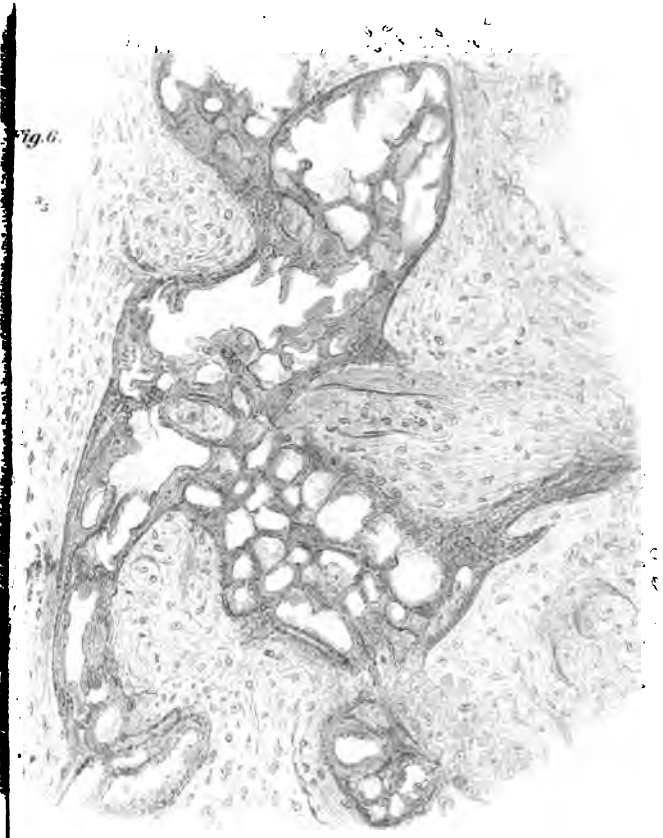


Fig. 6.

F Voit

Lith Anst v C Fr Lpz

Fig. 1.

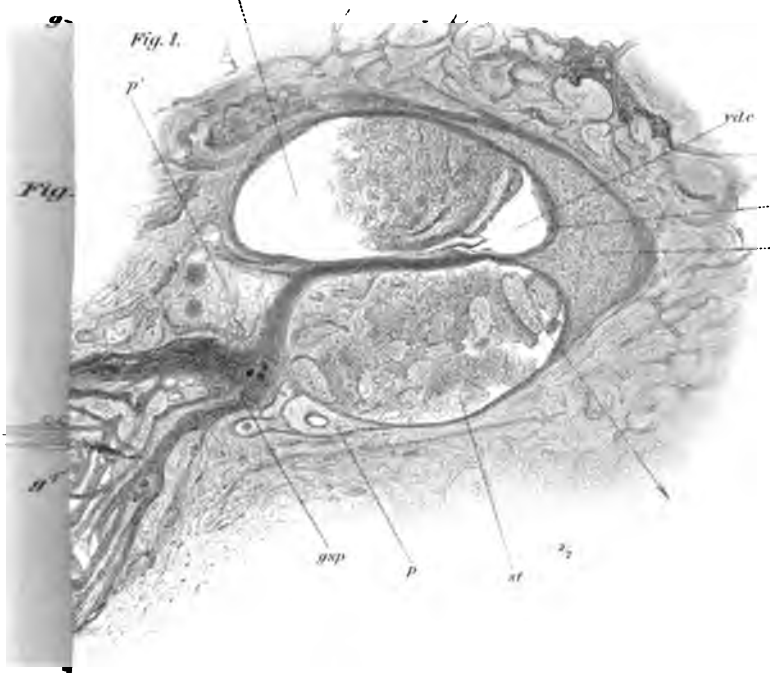


Fig. 6.

Fig. 4.

CONTENTS OF VOLUME XVIII., NUMBER 2.

1. Case of Purulent Meningitis in which Purulent Disease of the Middle Ear Invaded the Interior of the Cranium through the Labyrinthine Cavities and Fallopian Canal. By Dr. Jas. Finlayson and Dr. Thos. Barr, of Glasgow 115

2. Necrosis and Caries of the Temporal Bone Treated with Acids. By Dr. Ole Bull, of Christiania, Norway 123

3. Report of Cases of Disease of the Mastoid Process, with Remarks. By Henry Ferrer, M.D., San Francisco, Cal. 139

4. Report on the Progress of Otology during the Second Half of the Year 1888. Translated by Dr. Max Toeplitz, New York . . 183

   I.—Normal and Pathological Anatomy, Histology, and Physiology of the Ear and Naso-Pharyngeal Cavity. By A. Barth, Berlin.

   A.—Anatomy.

   B.—Physiology and Physics.

   II.—Pathology and Therapeutics. By A. Hartmann, Berlin.

5. Miscellaneous Notes 215

   The Technique of Dissecting the Normal and Pathological Human Ear. Practical Guide to the Diagnosis and Treatment of the Diseases of the Nose. By Dr. G. Ferreri.

NOTICE TO CONTRIBUTORS.

The editors and publishers of the ARCHIVES beg to offer some suggestions to authors who propose to favor them with their contributions.

1. As original communications the ARCHIVES can accept only such papers as have never been printed nor are intended to be printed in other journals. If a preliminary communication on the subject of a paper has been published, the author is requested to state this in the letter accompanying his manuscript. It is understood that contributors to these ARCHIVES and editors of other periodicals will make no abstracts of the original papers published in this journal without giving it due credit for the same.

2. Authors will receive gratuitously twenty-five reprints of their articles. If a greater number is desired,—notice of which should be given at the head of the manuscript,—only the additional cost of presswork and paper will be charged to the author.

3. In preparing manuscript for the compositor it is requested that the following rules be adhered to:

a. Write on one side of the paper only.

b. Write without breaks, *i. e.* do not begin a new sentence on a new line. When you want to begin a new line or paragraph at a given word, place before it in your MS. the sign ¶.

c. Draw a line along the margin of such paragraphs as should be printed in smaller type—for instance, all that is clinical history in reports of cases, etc.

d. Words to be printed in *italics*, should be underscored once, in SMALL CAPITALS twice, in LARGE CAPITALS three times.

4. Authors may receive proofs for revision if they will kindly return them without delay. We beg however to remind our contributors that changes in the copy are equivalent to resetting, causing so much additional expense. We therefore request them, to make, if possible, no alterations at all in their MSS., or, at least, to limit these to what is of essential importance

ARCHIVES OF OTOLOGY.

CASE OF PURULENT MENINGITIS IN WHICH PURULENT DISEASE OF THE MIDDLE EAR INVADED THE INTERIOR OF THE CRANIUM THROUGH THE LABYRINTHINE CAVITIES AND FALLOPIAN CANAL.[1]

By Dr. JAS. FINLAYSON, Physician to Western Infirmary, Glasgow, and Dr. THOS. BARR, Glasgow.

Dr. Finlayson said the patient was a man twenty-two years of age, a draper by occupation, who was admitted to the Glasgow Western Infirmary on December 18, 1888. He had been subject to a fetid discharge from the right ear since he had measles when four years old, and for a long time he had been in the habit of picking his ear with pins. Five weeks before admission, after picking his ear, it became unusually painful, and a considerable discharge of blood and matter occurred at this time; the lining of the canal also became so much swollen that the ear could not be examined at that time; the pain extended from the right ear to the occipital region. He was seen at that time by Dr. A. D. Stewart, who treated the ear affection: he seems to have found him markedly feverish; according to the patient, the temperature was 102° F. During the first two weeks of his confinement to bed he was very giddy, but, improving in the third week, he was able to get up, and even to go out in the fourth week. In a few days, however, he became worse, with pains in the jaw and behind the right ear; he thought these pains were aggravated on eating. This was on December 10th; by the 12th the pains on the right side of the face were much worse, but these ceased on the 13th, although the pains in the head itself then became more severe. He began to vomit on the 14th, and this continued till the 16th December. He was said by his sister to have had a bad shivering on the 14th. He was admitted on the 18th to the Western Infirmary.

On admission he complained much of pain in the head, both in

[1] Brought before the Glasgow Pathological and Clinical Society on 11th March, 1889, when sections of temporal bone were shown by Dr. Barr.

the frontal and the occipital region, and also of pain in the back, especially in the sacral region, and this portion of the spine was very tender on pressure ; his head was much retracted, so that he lay with difficulty on his back, and when he did so his eyes nearly looked to the wall at the head of his bed. The pain in the back prevented him from sitting up in bed ; it was found that he could turn round on to his elbow, and even towards his face : in these movements his back seemed to move as a whole. He could, however, sit on the edge of the bed ; while seated thus the knee-jerk was found to be almost or entirely absent. He was found to be able to stand and walk a step or two with assistance. His temperature was high (102°–103° F.) ; pulse about 90 ; respiration, 36. Tongue furred and dry. Intelligence very good, his answers being clear and precise.

On admission, Dr. Finlayson said the patient presented most of the typical symptoms of cerebro-spinal meningitis, but there were no eruptions or blotches of any kind on the skin. The presence of a chronic ear disease on the side affected with the severe pains, and the clear history of a recent exacerbation of the aural condition, made it almost certain that the acute illness was connected with these facts. Moreover, a slight, but perfectly distinct, paralysis of the facial nerve on the right side, apparently of five weeks' duration, pointed in the same direction. This affection of the facial nerve was the only distinct paralysis detected. Dr. Barr's examination of the ear showed that while hearing by air-conduction was extremely defective in the right ear, the bone-conduction, as tested both by Weber's and Rinne's test, was in excess. Polypoid excrescencies were also found in the right meatus (which Dr. Barr removed subsequently), but there were no evidences of mastoid irritation. The left ear was practically normal. On examination of the eyes by Dr. Reid, there were signs of papillitis of a mild type in the left ; the right seemed normal, but could not be examined thoroughly. Nothing special was found on examining the chest or abdomen.

After admission the patient continued feverish (102°–103° F.), and in two or three days it was found, that although his headache was apparently less severe, the intelligence was much obscured, although he could sometimes answer sensibly. At times he had marked shaking of the jaw, and also of the right hand while trying to take a drink, but no general rigors occurred. The pupils remained equal and were found to contract readily to light. The

retraction of the head varied, but was distinctly less after the patient became more stupid. The abdomen was not retracted; the so-called *tache cérébrale* was well marked. The catheter had only been used once, viz., on the day he died. The bowels required medicines and enemata. The urine contained no albumen, but a very distinct reaction of sugar was obtained; a quantitative analysis showing, in the specimen examined, 0.25 per cent. of sugar. The confusion of mind deepened into a stupor before death, and the day he died he vomited once, for the first time since admission; hiccough and general tremulousness preceded the terminal coma. The temperature reached 104.2° F. three hours before death. He died on December 24th, about a week after admission, and six weeks after the first onset of the acute symptoms.

In discussing the diagnosis, Dr. Finlayson said that the connection of the meningeal symptoms with the ear disease seemed perfectly plain, although even with this in view the idea of a cerebro-spinal affection was strongly suggested, not only by the extreme retraction of the head, but also by the pain and stiffness of the back. The idea of a cerebellar abscess was likewise discussed, as abscess in this situation occasionally follows upon ear disease, and marked retraction of the head has been observed in such cases. In considering the question of abscess, attention was directed to the region of the jugular veins to ascertain if there were any tenderness there suggestive of thrombosis or inflammation in the region of the lateral sinus, but no such tenderness existed there or behind the insertion of the sterno-mastoid. After an anxious consideration of the case in view of any possible surgical interference, the only definite conclusion open seemed to be that formulated by Dr. Barr, that the symptoms pointed to purulent disease in the posterior fossa, but whether meningeal inflammation of this type or cerebellar abscess seemed doubtful. The symptoms in most respects strongly suggested meningitis; on the other hand, the two periods in the acute illness, separated by a week's interval, during part of which the patient could go about, seemed liker the course of an abscess, and the occurrence of a rigor a few days before admission, with the be-

ginning of the second period of illness, rather pointed in the same direction.

The *post-mortem* examination showed the case to be one of purulent meningitis, apparently occurring in two attacks; unfortunately an examination of the head only was permitted, and so the state of the spinal cord could not be ascertained; a portion of it cut out, as far below the foramen magnum as possible, seemed to show an absence of deposits in the membranes there. There was no thrombosis in the longitudinal sinus, and none in the lateral sinus. The vessels of the pia mater, and especially the veins, were much engorged all over. On the convexity, on the right side, at the edge of the longitudinal fissure at the upper part of the frontal convolutions, a little purulent exudation was found, and a similar but slighter deposit was found on the left side at the posterior part of the frontal convolutions. On removing the brain a considerable amount of fluid was found at the base, and this presented a purulent admixture in the region of the medulla. The brain was found to be adherent near the right internal auditory meatus, and it had to be dissected off the membranes and bone; there was at this spot a piece of necrosed tissue, partly brain substance and partly membrane. This portion was found to be the very anterior extremity of the right lobe of the cerebellum; this destructive process had extended slightly to the side of the pons at its posterior part. The base of the brain presented extensive purulent inflammation. This process seemed to have extended from the spot where the pus oozed out on dissecting off the adhesion, towards the side of the medulla and to the inferior surface of the cerebellum, crossing over to the left side also; the purulent deposit extended about an inch both to the right and left of the middle of the cerebellum, behind the medulla. On the right side of the cerebellum, in this situation, a distinct membrane could be stripped off, leaving inflammatory products still visible on the pia mater; in this membrane, as stripped off, injected vessels could be seen. On dissecting up the medulla oblongata so as to expose the fourth ventricle, some gelatino-purulent exudation was

found in both its anterior and posterior aspect. Considerable inflammatory exudation existed at the optic chiasma. There was no very marked inflammatory deposit on the surface of the temporo-sphenoidal lobes. The cerebellum was not adherent to the cerebrum above. Some adhesion of the anterior lobes to each other was present, with distinct exudation on the inner surface of the right lobe. The fissures of Sylvius were likewise somewhat adherent.

The ventricles were moderately distended. No lesions were found in the brain substance, except the destruction of the small portion of the cerebellum and adjacent part of the pons already described.

The pus which oozed from the internal auditory meatus was very fetid, and there was obvious disease of the petrous bone; this was removed for further examination by Dr. Barr.

Examination of temporal bone by Dr. Barr.—On removing the anterior wall of the external canal of the ear, the greater part of the membrane was seen to be destroyed, only a rim of 2 *mm* in breadth remaining at the lower part. A mass of granulation tissue protruded from the cavity of the tympanum, especially at the upper and back part. On separating the temporal bone into two parts, through the Eustachian tube, tympanic cavity, and mastoid cells, the granulation tissue was seen to spring partly from the antrum mastoideum, but chiefly from the inner wall of the tympanic cavity, especially above and behind. On carefully removing this granulation tissue, Dr. Barr found embedded in it the stapes, quite detached from its fenestra, and the facial nerve quite denuded of its bony casing. At that part therefore where the Fallopian canal courses behind and above the fenestra ovalis, the bony casing of the canal had been completely destroyed, and the nerve lay quite exposed in the cavity of the tympanum. The malleus, partially destroyed by caries, was also embedded in granulative tissue, and lay in contact with the outer wall of the upper tympanic cavity. The incus was absent.

The mastoid cells, with exception of the antrum, were obliterated and converted into hard, dense bone. The an-

trum was, however, dilated, forming a cavity of much larger dimensions than that found in health, lined by thickened mucous membrane and filled with decomposing caseous-looking pus. Only a very thin plate of bone separated this cavity from the middle fossa of the cranium above.

The inner or labyrinthine wall of the tympanum showed the most striking changes. Irregular carious openings were found, communicating with the interiors of the semicircular canals, the vestibule, and the cochlea. The fenestra ovalis was much enlarged by carious erosion; the fenestra rotunda was, however, closed by hyperostosis. On reflecting light into these gaps, a dark aperture was seen at the fore-part of the inner wall of the vestibule; this was the situation of the fossa hemispherica, which, instead of being a perforated lamina through which, in the normal condition, the fibres of the vestibular division of the auditory nerve pass, was a simple hole, enlarged by carious erosion; the nerve, much thickened, ended here. At the lower and fore-part was seen the entrance to the scala vestibuli of the cochlea, while at the posterior part were seen two openings into semicircular canals.

On removing the roof of the internal auditory canal, the auditory nerve, inseparably united to the facial, was exposed, forming a thick reddish mass. The cribriform lamina was eroded and destroyed by caries, so that no hindrance existed to the passage of purulent matter to the internal auditory meatus. The facial nerve was seen in its windings from the internal auditory canal to the stylo-mastoid foramen. The first part of its course (the horizontal part), as it passes straight outwards to the geniculate ganglion, was artificially exposed, and here the nerve was seen to be red, enlarged, and somewhat softened. In the second part of its course, where it abruptly turns backwards almost at right angles to the first part, and curves round the fenestra ovalis, it was quite denuded of its bony casing, and was of a reddish color. This part of the nerve was embedded in granulation tissue. The third or vertical part, which was in great part opened into by the chisel, was normal in appearance.

On the upper surface of the petrous part, a very small carious aperture was found communicating with the interior of the cochlea. There was no evidence, however, of its having participated in the extension of the disease to the brain. Over the superior semicircular canal the bone was slightly discolored, softish, and friable. This was easily picked off with forceps, exposing the white, dense, bony capsule of the canal partially opened into.

Remarks by Dr. Barr.—The temporal bone in this case illustrated a rare though not unknown mode by which purulent disease of the middle ear may extend to the intra-cranial cavity, namely, by the labyrinthine cavities and Fallopian canal to the internal auditory meatus. The most frequent directions by which disease of the middle ear invades the interior of the cranium are through the roof of the middle ear to the middle fossa (temporo-sphenoidal lobe), and through the inner wall of the mastoid cells to the posterior fossa (the lateral sinus and cerebellum). The bony partitions, however, in these situations were intact, but the inner or labyrinthine wall of the tympanic cavity and the osseous casing of the facial nerve, as well as the cribriform plate, were broken through by caries.

In regard to the denuded condition of the facial nerve in the tympanic cavity, some may doubt whether this was not a congenital condition. It is well known that small gaps are sometimes found in the bony walls of the Fallopian canal, at that part where it is found so closely related to the tympanic cavity. It is indeed probable that many of the cases of facial paralysis which occur during an inflammation of the middle-ear may be due to the circumstance that a gap exists in the bony casing of the nerve, and that thus the mucous membrane of the middle-ear and the neurilemma of the nerve are in contact. Here, however, I think there is no doubt that the nerve has been laid bare by carious erosion, and although the stem was not destroyed at any part, the pressure of the granulation tissue and of the purulent secretion, as well as the inflammatory process in the nerve itself, would give rise to the facial paralysis.

The state of the bone-conduction was a remarkable feat-

ure of this case. Here the labyrinthine cavities were occupied by pus, and the membranous labyrinth, with the terminal structures of the auditory nerve, were destroyed, and yet perception of sound by bone-conduction still existed, and, what was still more remarkable, the tuning-fork applied to the middle line of the head was heard louder in the affected ear (Weber's test). At the time when this test was employed the patient was quite intelligent, and considering that the result was opposed to what the patient would have expected, there is no reason to doubt the accuracy of his statement. This peculiarity has been met with by other observers, such as by Dr. Jacobson (Berlin), who related to the otological section of the Versammlung Deutscher Naturforscher und Aerzte, in Cologne in 1888, a case in which there was similar destruction of the labyrinthine structures while the tuning-fork on repeated testing was heard almost exclusively on the affected side. Here the test was applied on several occasions, and always with the same result. Such instances rather detract from the importance of this test in diagnosis, and may lead to a modification of opinion as to the value of this method, or as to the nature of the process of bone-conduction.

It is interesting to notice in connection with the presence of sugar in the urine, observed in this case, that Dr. Gairdner recorded, in the *Glasgow Med. Journal* (Oct., 1887), a case in which diabetes mellitus was associated with brain disease and paralysis of the portio dura, which originated in purulent disease of the middle ear.

NECROSIS AND CARIES OF THE TEMPORAL BONE TREATED WITH ACIDS.

By Dr. OLE BULL, of Christiania, Norway.

CARIES and necrosis of the temporal bone is any thing but a rare disease. So far as my experience goes, I have found it the oftener the closer I have made my investigations, and still I think that the cases in which I have overlooked it are quite as numerous as those in which I have been able to state it. The diagnosis is indeed, apart from the well-pronounced cases, quite difficult, and in most instances we must have the patient under observation for a longer time, before we can discriminate the real nature of affection. The most reliable symptom, the grating felt under the probe, is available only when the affected part is accessible to the instrument, and even then (when necrosis and not caries is present), it cannot always be felt. Consequently, the negative result of probing is not of great value. The constant reappearance of granulations in the same place in which they have been destroyed is a symptom which pretty surely proves the presence of dead bone, but this can only lead us to the right diagnosis when the affected part lies in a visible spot. Not seldom the place in which the perforation of the drum is seen may at an early period awake the belief that a mortification of the bone has taken place. It is a well-known fact that the place of predilection to the carious processes is the innermost and upper part of the bony meatus and the adjoining part of the roof of the tympanic cavity. Consequently, when we see a perforation in the drumhead, especially when this perforation has a

crater-like appearance, we shall seldom fail, sooner or later, to find caries of the meatus, or of the roof of the tympanic cavity. The peculiar smell of the discharge is also very suspicious, but not so constant that its absence can constitute negative proof of bone affection. In the majority of cases the surest evidence of necrosis is the persistency of the discharge, in spite of careful and prolonged treatment.

When we have satisfied ourselves of the presence of caries, the indication for removal of the diseased bone is given. How this indication is to be met will, however, be difficult to answer in many, if not in most, cases. The old belief, that by any constitutional treatment we may be able to exercise any curative effect on this affection, must be classified among the legends. The given indication can only be fulfilled by local treatment, either in a mechanical way, viz., operation, or by chemical means. Operation is, from reasons set forth above, for the majority of cases impossible to be carried out. Even when we have been able to find the place of the affected part, we cannot always perform an operation without too great risk to the patient's life. From a theoretical point of view, it will be much safer to use chemical means, viz., acids, by which we can act on the dead bone so as to make it absorbable. Being fluid, the acids are not restricted to the parts accessible to hand and sight; their action need not to be of any injury to the healthy parts surrounding the affected bone. That acids sufficiently diluted can be applied to the surface of the tympanic cavity without causing dangerous inflammatory reaction is proved by Mathewson[1] and Weber-Liel,[2] as regards surphuric acid. Furthermore, Woakes[3] has used a lotion of sulphurous acid of the same strength as given in the Pharm. Brit.

Concerning the effect of sulphuric acid, I cannot speak from personal experience. Since I read the paper of Woakes, I have used sulphurous acid in a great number of cases. I must, however, confess that only in two or three

[1] Transactions of the Amer. Otolog. Soc., '78.
[2] *Monatsschrift für Ohrenheilk.*, '85.
[3] *Ann. des Malad. de l'Oreille*, etc., '84. In the communication of Weber-Liel, and in the last edition of Gruber's Otology, '88, sulphurous acid is incorrectly translated sulphuric acid.

cases I have seen any benefit of it, and even in these it appears to me doubtful whether the good effect was to be attributed to the decalcifying action of the acid or to its antiseptic property. A great inconvenience to this remedy is the pain which it causes when employed for a protracted period, and in a state not too much diluted. The pain has, in fact, often been so intolerable that I have been compelled to desist from using it, and have gone back to milder antiseptics, such as solution of hyperoxide of hydrogen, perchloride of hydrargyrum, etc. By these, combined with a thorough cleansing of the parts, I have sought to prevent self-infection, meanwhile hoping that a happy fate would save my patients from all the other sad results to which carious or necrotic processes of the temporal bone too often lead. Although this "laisser aller" treatment was anything but gratifying, I went on with it till, in the summer of '87, I got a case of caries in which the circumstances were such as to call for a remedy, whereby the sequestrum could be removed in a gentle manner, without resorting to operation. So I took the question for decalcifying the dead bone under renewed consideration.

The power of an acid to dissolve the earthy substances of the bone depends on its chemical combination, and on the solubility of the new-formed salts. Beyond this, its power to act on the organic substances of bone must be taken into consideration. Not knowing how the different acids would act, I commenced to make a series of experiments with different acids of different concentration, in order to find out which of them in the shortest time could decalcify bones of a certain size. I took plates of compact bone, (shavings of bone used in playing at cards), cut them up in squares of the same size, and tried with the following acids: Ac. hydrochloricum, nitricum, phosphoricum, sulphuricum, and sulphurosum. Of the last I took a solution corresponding in strength to that of the Pharm. Brit., containing about 9 per cent. volume gas in distilled water. The other four I have used in solutions of 1, 2, 3, and 4 per cent. The quantity of the solution, as well as the size of the squares, has been varied in different series of experiments. In each

series the experiments have been done under quite analogous circumstances, but notwithstanding, the time required to decalcify a square of a certain size in the same quantity of a given acid has not always been the same. Probably this has been caused by some differences in the structure of the bone. Such differences may exist even when the squares are cut out of the same plate. That for most acids it is difficult to ascertain at what time the squares are decalcified must also be taken into account. As a rule, the difference has been slight for the same acid, but, as might be expected, great for the different acids, as shown by the table No. I., in which I have compared the result obtained when using 4-per-cent. solutions of the different acids in a quantity of 3 grammes.

No. 1. Four-per-cent. solution. Three grammes.

	A. hydrochloricum. Time for each experiment.	Average.	A. nitricum.	Average.	A. phosphoricum.	Average.	A. sulphuricum.
Squares of 3 *mm* linear extent and 1.2 *mm* thickness	5. 4.30' 5.30'	5	7.20' 10. 6.30	7.54'	21. 21. 27.30'	23.10'	Circ. 12 days.
Squares of 4.5 *mm* linear extent and 1.2 *mm* thickness	4. 4. 5	4.20'	9. 8.30 7.	8.10'	33 30.30 34	32.30'	
Squares of 6 *mm* linear extent and 0.6 *mm* thickness	3.45 4	3.42'	7. 9	8	24.27.	25.30'	Circ. 8 days.
		4.20'		8.2'		27.3'	

It appears from this table that hydrochloric acid, in a shorter time than any other acid used, is capable of decalcifying bone, the proportion being when the time for this acid is taken = 1, for nitric acid = 2, for phosphoric acid = 7, and for sulphuric acid 50 to 60. The last acid is, as could be expected from the insolubility of sulphate of lime, far inferior compared with the others. When weaker solutions are used we find that the relative time for the first three acids remains about the same, as may be seen from the tables Nos. 2 and 3.

No. 2.	Three-per-cent. solution.				Three grammes.	
	A. hyrochloricum. Time for each experiment.	Average.	A. nitricum.	Average.	A. phosphoricum.	
Squares of 3 *mm* linear extent and 1.2 *mm* thickness	5. 6. 5. 6	5.30"	9. 8. 11. 13.	10.15"	51.30" 52.30" 45.30" 48.	49.22

No. 3.	Two-per-cent. solution.				Five grammes.	
	A. hydrochloricum. Time for each experiment.	Average.	A. nitricum.	Average	A. phosphoricum.	
Squares of 3 *mm* linear extent and 1.2 *mm* thickness	10.15" 10. 11.10"	10.28"	17. 18. 18.	17.40"	70.15" 62. 73.	68.25"

The average time for the experiments related in these three tables is 6.46″ : 11.48″ : 48.17″, or, approximately, 1 : 2 : 8.

For sulphurous acid I have not been able to fix any time. I have had squares of 3 *mm* × 1.2 *mm* immersed in 15 grammes solution in a well corked and sealed glass for 300 hours. When opening the glass the smell from the gas was very strong. The bone was found bleached and slightly swollen; its upward turned side was so far decalcified as to admit a sharp knife to be thrust in for a little depth; the other side turned to the bottom of the glass was quite hard. From this we can conclude that it would take a very long time to decalcify pieces of bone of a size of some cubic millimetres. Small pieces taken from the cancellous substance are, however, decalcified when laid in solution of sulphurous acid for some hours. As some sulphuric acid after a time always is formed in aqueous solutions of sulphurous gas, the dissolving powder of the last may be attributed to the first named.

From table No. 1 is seen that the shape of a bone is a factor which has a great influence on the time necessary to dissolve its earthy substances; the larger its surface is in proportion to its volume, the shorter is, as may be expected, the time. Squares of 6 *mm* and 0.6 *mm* thickness = 21.6

cub. mm required but little more time than those of 3 *mm* × 1.2 = 10.6 *cub. mm.*

Beyond the great difference in time needed for the different acids in decalcifying bone, we find that their action differs also in other respects. Some acids, for instance sulphuric acid, swell the gelatinous substance. The thickness of the plates may be found increased from 25 to 30, or even in some places to 35, of their natural thickness. Partly this increase of thickness is due to deposits of sulphate of lime. A slight increase of thickness I have found also in plates placed in solutions of muriatic and nitric acids, but this increase seems to disappear when the plates are wholly decalcified. At least I have not been able to determine under the microscope any visible difference between cuts of such plates and those of the bone in its natural state. In solutions of phosphoric acid the form of the bone seems always to remain quite unaltered.

The bone when acted on by the different acids assumes different aspects. Phosphoric acid makes the squares quite transparent, so that the time necessary to decalcify them can be exactly ascertained by sight alone. When left in the solution for a time the part not decalcified is seen by transparent light as a dark square surrounded by a pellucid one. The process appears to be well defined, as with an ordinary magnifying glass the borders of the opaque part are well distinguished from the transparent ones. Hydrochloric and nitric acids give the squares a milky appearance, so that it is not possible to see when they are decalcified. The plates must be taken out of the solution and cut into. It is possible therefore that the time recorded for these squares has been too long compared with that for those immersed in phosphoric acid. More probably, however, the possible faults lie on the other side, as the cuts made in the squares to try their hardness give a freer access to the acid. The sulphuric acid produces a still more saturated white color to the plates. When washed out in water and dried the plates decalcified in hydrochloric, nitric, and phosphoric acids all take quite a pellucid appearance. Those in sulphuric acid, however, remain opaque, being

covered with white spots (sulphate of lime). I must not omit to say that the temperatures of the solutions during the experiments have been tolerably even, varying between 15° and 20° C.

It appears rather strange that mineral acids have not been used more frequently in carious and necrotic processes than hitherto has been the case. Not only are they excellent remedies, due to their chemical effects in extracting the earthy substance from the dead bone and thereby making it absorbable, but they are also valuable antiseptics; the most offensive smell is invariably removed when the affected part is soaked with a mixture of mineral acids not too much diluted.

The acid which up to this time almost exclusively has been used seems to have been the sulphuric acid. It has been tried both pure, in which state it acts mainly as a caustic, and diluted. G. Pollock,[1] who used it in both forms in cases of carious and necrotic processes of different bones, applied it pure in affections of the bone of the trunk; in those of the head he recommends a mixture of equal parts of concentrated acid and water. In the last form he says that it usually does not affect the soft tissues, nor does it irritate them subsequently. It is interesting to see that Pollock has used it with good result in cases where the pulsation of the brain through the exposed dura could be distinctly observed close to the edge of the necrosed bone. From the description given in Pollock's cases I should, however, think that the acid in this rather concentrated form acted more as a caustic, or a powerful stimulant, than as a solvent. The dead bone is said to be crumbled away from day to day in minute fragments. In the auditory canal and tympanic cavity, sulphuric acid has also been used, both pure and diluted, by Weber-Liel. The effect of the diluted acid seems, however, not to have been studied more closely; at least no details of it are given in the article.

[1] From his article in the *Lancet* I see that M. Chassaignac ("Mémoires de la Société de Chirurgie," vol. iv.) has tried and strongly recommended the use of muriatic acid for necrosis of bone generally. Dr. Pollock quotes Holmes ("System of Surgery," vol. viii., p. 637), who says that he has not found much benefit from its use. The works of Chassaignac have not been accessible to me, wherefore I do not know how concentrated he used the solution, or if he ever tried it in affections of the temporal bone.

It is exclusively as solvents that I here shall speak of the mineral acids. It has not been my plan to study their effect as caustics. As such they all, except chromic acid, may be superfluous in otological practice, as in the galvano-cautery we have a remedy by which we can reach our aim in a shorter and less painful way. From the experiments made in glasses, we can only come to the conclusion that muriatic acid of all the acids tried is the best solvent for the earthy particles of bone, and that the sulphuric, and still more the sulphurous acid, are rather unserviceable for the same purpose. How the different acids act in the meatus and tympanic cavity is another question which remains to be solved. Many things are here to be taken into consideration. First, how they are tolerated in the auditory canal and tympanic cavity. In this respect I have not found any difference. They all cause pain in the canal and drum cavity when applied too often. In the former I have once seen a circumscribed necrosis of the skin close to the outer aperture follow upon repeated instillations of a 2-per-cent. solution of muriatic acid. In the latter I have three or four times observed inflammation ensuing after a single application of cotton soaked in a 4-per-cent. solution of muriatic or nitric acid. The inflammation was accompanied with decrease of hearing, but disappeared in a couple of days without leaving any traces. In the tympanic cavity acids are tolerated much better. Whether this is caused only by attenuation, or even neutralisation, of the acid, I shall leave unanswered. I can only state that usually the fluid retained in the cotton has had an exquisite sour reaction, when removed after twenty-four hours. In some few cases it was found neutral, or even of an alkaline reaction. Provided, therefore, that the indication is only to remove a sequestrum which, on account of its size, cannot be taken out through the auditory canal, or to decalcify a bone so situated that we need not fear the consequences of pressure on its surroundings if it should swell, the acid which does this in the shortest time is preferable. It is, however, doubtful whether or not the same holds good when the dead bone is deeply situated, in continuity with healthy bone, and for the greatest part

covered by its natural linings. In such cases we have to take into consideration the swelling whereby invariably the vital process, tending to absorb the decalcified or partly decalcified bone, seems to be inaugurated. That such swelling, in a mechanical way possibly, can give rise to unpleasant complications, is *a priori* not at all unlikely. From this point of view it may be advisable in some cases of deep-seated necrosis first to try phosphoric acid, or a very weak solution of muriatic acid, especially when the effect cannot be watched daily. The following notes from some cases are taken as samples of differently located necroses.

CASE I.—Peter Ouren, five years, was brought to my office 8th of June, '87. He was rather a delicate and pale-looking boy. Two years previously he had scarlatina, at which time his ears began to discharge, and have continued to do so ever since. He heard a watch brought into contact with concha (normal distance three feet *h.* = $\frac{c}{36}$). Otoscopically: drums mostly gone; on right side malleus with a little part of the manubrium present; on the left all ossicles gone. He was treated for a while with boracic acid (method of Bezold) and later with instillation of spiritus absolutus, pure and with some boracic acid solved in it. The discharge soon diminished but did not entirely cease. In the middle of July I noticed on the left side denuded bone in form of a stripe at that place, which normally is covered by the hammer handle. At that time the patient was taken home. I saw him again towards the end of October the same year. He could then hear ordinary conversation at one foot both sides. Still some discharge. Otoscopic. right side unchanged; left, most part of promontory denuded. The naked bone is of a yellowish-white color. Its superficies smooth; its inferior and superior margins are free and here the end of a bent probe can be introduced under it. It feels firmly attached to the substratum. Attempts to move it cause pain. One drop of concentrated nitric acid was put on the bone by a small glass rod every second or third day for four or five weeks. This made the superficies uneven and of a dark color in the centre. The exfoliation gradually became so manifest, that I tried to remove the bone with a pair of forceps. As it, however, was rather large and not quite separated, I did not succeed. At the beginning of December the patient was infected by measles and taken home. Towards the end of August, 1888, I saw him again.

The dead bone was then quite loose, but of the same size as before. Attempts to remove it still causing pain I introduced some drops of a four-per-cent. solution of nitric acid into the ear and left it there for half an hour. Having repeated this twice the bone became so diminished that it easily could be taken out. The inner wall of the tympanic cavity appeared to be covered with a membrane, in the anterior part of which was seen a hole through which a probe could be introduced 1.5 *mm.* He can understand whispering at one foot's distance on both sides.

In this case I several times proposed to remove the bone by an operation, but as the relatives of the patient did not consent to the use of anæsthetics, and it was impossible to do without them, on account of the great sensitiveness and timidity of the boy, I had to give it up. Whether or not the use of absolute alcohol had occasioned the sloughing of the mucous membrane and secondarily necrosis of the bone, I leave undecided. On the right side it produced no necrosis.

CASE 2.—Oline Larsen, fifty-one years old, has been rather hard of hearing as long as she can remember. Five years ago she was taken ill with general stiffness and cold in the whole body, accompanied by dizziness and pain in the head. The dizziness forced her to keep her bed for a week. Since that time she has always been liable to dizziness especially when she suddenly turns round. In June, 1887, she had humming in the ears and the hearing became worse. Three or four weeks ago she noticed some discharge from the ears. She can hear a watch when applied to auricle right side. Left she cannot hear either watch or acoumeter of Politzer, but tuning-forks of usual size close to the ear. Very loud conversation is heard at one to two feet. Air-douche by Eustachian catheter reveals good permeability of the tubes on both sides; on the right a whistling sound as by perforation of the drum. Otoscopically, both sides, membranes much retracted; rather large defect in the innermost part of the bony wall, especially on the left side. In the opening a bone of brownish color and uneven surface is seen to protrude. Immediately under it the stapes with its muscle protrudes free into the auditory canal. It is freely movable and by moving it the patient heard a grating sound. The bone is situated 3 or 4 *mm* farther in

than the upper margin of the membrane; it proves immovable; no grating under the probe; pressure on it leaves small spots of blood (*vide* fig. 1). On the right side swelling of the auditory canal makes it difficult to perform a closer examination of the site of the bone. Pieces of dark crust and half-dried exudation incompletely cover the parts on both sides. On the upper and innermost part of the wall of the auditory canals some granulations are visible. Syringing sometimes, especially when the fluid was not sufficiently warm, causes dizziness. On the right side the fluid passes into the corresponding nostril.

When the parts had been thoroughly cleansed, I commenced to use a solution of muriatic acid, first 2-per cent., then, as this was borne without inconvenience, 4-per cent. Small pieces of cotton were soaked in acid, and laid on the bone. Twenty-four hours later, when the cotton was removed, the fluid retained in it usually was found to be of a neutral reaction. The color of the bone soon changed into white; by the probe it was not felt so hard. When touched by a sharp instrument spots of dark blood appeared. After four applications of the acid the bone became somewhat enlarged (*vide* fig. 2). At the middle of December it began to diminish. The superior part was gradually absorbed, whereby a lower more prominent lump was formed. This has lately diminished more and more, and a little cavity about 1 *mm* behind its anterior margin has formed on its outer surface (*vide* fig. 3). The bone is now harder again, and does not bleed so easily when touched with a needle. Unquestioned, the patient states that she feels much better; the dizziness has become less, and she is clearer in the head and not so bewildered as before. Hearing variable, but usually a little better.

FIG. 1. FIG. 2. FIG. 3.

(The patient held her head bent to her right side, at an angle of 25° to 30°, when the drawings were taken.)

The bone here denuded must be considered half necrosed. Its uneven surface coated by crusts showed that its nutrition from the periphery was cut off, but the hemorrhages appearing when the

bone was touched with a sharp instrument proved that it was pervaded by vessels, and consequently not a sequestrum. That the swelling after application of acids in this case was but slight, I would explain by the absence of periosteum. The periosteum furnishing the bone with the greatest part of regenerative material, the reactive process tending to absorb the decalcified bone must be relatively slow. Considering the large destruction of the inner upper part of the auditory canals, we must believe that the process began on this favorite spot of necrosis.

CASE 3.—Johan Reiss, Arendal, thirteen years old, came under my treatment the first time in the winter of 1884. He had then on the left side a chronic suppurative otitis media of several years' standing. A polypus was on the anterior wall of the meatus. After four weeks' treatment the catarrh ceased. No relapse before the beginning of 1888. I saw him again at the end of August. Rather copious discharge of an offensive smell. At the upper margin of the drum was a hole the size of a hemp-seed. The hole was partly filled with necrosed tissue; some granulations at its upper circumference (*vide* fig. 4). By probing, denuded bone could be felt at the bottom of the hole, but no grating. He can hear the watch at one inch; with the right ear at two feet. By Eustachian catheter, good permeability of the tube. No whistling sound that could indicate perforation. When the granulation was destroyed, grating could be felt in the upper region. He was treated with muriatic acid, 4 per cent. lotion once or twice weekly. After four applications a whitish mass gradually filled up the hole, so that no probe could be introduced (fig. 5). At that time the patient felt a slight throbbing pain in the ear for a short period. The mass was of a consistence like cartilage. When touched with a pointed instrument small spots of blood appeared. The use of the acid was suspended as soon as the white mass appeared. When in the course of three to four days it had been absorbed, the bad smell of the discharge came back, until a renewed application of acid caused it to vanish and the white mass to reappear. In the beginning of October the hearing in the affected ear commenced to improve; the discharge, having been scanty for a time, entirely disappeared. A probe, bent at an angle of 115° at a distance of one *cm* from its end, could be introduced (so far that the angle just touched the upper margin of the cavity), while its end was still felt free. The upper circumference of the hole is undulate. Processus brevis mallei had become absorbed

(fig. 6). The patient was kept for a couple of weeks under observation, to see if any relapse should come on. When leaving he heard watch at 10 inches, $h = \frac{10}{10}$.

FIG. 4.

FIG. 5.

FIG. 6.

In the last six months I have treated several patients with caries of the inner upper part of the bony meatus, in which the affected bone has been situated on a place corresponding to that in the above case. In most of these cases there was no communication with the tympanic cavity. The affected bone has been found almost constantly covered with polypoid growths or granulations, which were destroyed with the galvano-cautery or chromic acid. Afterward, a hole has usually been visible, varying in size from that of a pin-head to that of a hemp-seed. When hydrochloric acid had been used for a couple of times, the hole has been filled with a vascular mass, showing spots of blood when touched with a sharp instrument. It can hardly be doubted that this mass was cartilage proceeding from the bone bordering the dead or half-dead part. The final result was that a hole with smooth margins, and considerably larger than that originally visible, has formed in the region above the drumhead. This hole has been the entrance to a cavity of more or less extension.

The prognosis is good in cases where the affection is limited to the meatus and the adjoining part of the roof of the tympanic cavity. If I take into consideration only the patients that have remained sufficiently long under treatment, I have had in the last six months seven patients in whom a cure had been obtained in an average time amounting to a little less than eleven weeks (in no case less than four and longer than sixteen weeks). The hearing has in all cases been considerably improved. In cases where there has been communication with the tympanic cavity, or where symptoms indicating an affection of the malleus have been present, the result has not been so favorable.

CASE 4.—Julie Halvorsen, eight years old, was brought to my office September 24, 1884. Three years previously her left ear had commenced to run. Cause unknown. A sister died at the age of fifteen years, from a brain affection caused by a chronic purulent otitis, from which she had been suffering since childhood.

St. pr.: right ear normal; left, discharge of an offensive smell. In the drumhead a perforation of the size of a hemp-seed close to the posterior margin. She was treated with different antiseptics, and during a long period with sulphurous acid in accordance with the method of Woakes. As long as she remained under treatment the discharge was scanty and inodorous, but when during the holidays she stayed away for a couple of months, it became more copious and offensive. During these periods the perforation increased in size, the greater part of the *Mt* being finally destroyed. In the fall of '86 a small granulation appeared on the posterior part of the promontory. This granulation was repeatedly destroyed, but reappeared after a shorter or longer period. Later grating could be felt by touching the spot where the granulation was visible. In the middle of September, '88, I commenced to use instillations of nitric acid of 4 per cent. The effect of this treatment was soon visible so far as the manubrium, which had up to that time been seen as a straight line, fixed by its free end to promontory, after a couple of instillations became flexible and somewhat swollen. The instillations were soon substituted by small pieces of cotton soaked with acid, laid upon the place where grating was felt. The fluid retained in the cotton when the latter was removed after twenty-four hours was generally found neutral or of a slightly acid reaction. After these applications had been used a couple of times a whitish, rather consistent growth, which proved to be vascularized, came forth. By and by the manubrium became curved against the hammer-head. Later when hydrochloric acid was substituted for nitric, the growth increased in size, protruding 6 to 7 *mm* over the promontory. Its size was unaltered for a couple of days, during which the discharge almost ceased. The use of the acid was stopped when the growth was visible, but as the discharge and the bad smell had reappeared when this had gone back, the acid was applied again.

The patient is still under treatment. Probably the affected bone in this case is deeply situated, and it may be doubtful whether or not acids in this case will bring on a cure. For

a while I tried instillations of 2-per-cent. lotion of hydrochl. acid, thinking that perhaps other parts of the temporal bone than the promontory might be affected, but not only did these instillations cause pain when used repeatedly, but they also caused a round ulcer about 3 *mm* in diameter in the skin of the meatus, near its outer aperture. As this ulcer went through the whole cutis, its healing took a couple of weeks.

That the manubrium in this case, in spite of the prolonged treatment with sulphurous acid, preserved its stiffness, shows how little this acid is apt to decalcinate bone, however slender it may be, when protected by periosteum.

I have given an account of the last three cases in order to illustrate how acids act on bone that is more or less denuded, but still in connection with the body. In Case 2, where the affected bone was situated deep in, and consequently for the most part out of contact with, the periosteum, we see that the acid occasioned but *little* swelling. In Case 3 the swelling must have been relatively *greater* as the supposed cartilage repeatedly filled up the perforation. Once this patient had symptoms indicating pressure (slight pain and throbbing in the ear) some hours after the application of the acid. In the last case, where the affected bone was still covered with periosteum (mucous membrane), we see a *very great* swelling again and again following the applications of acid.

It is not improbable that mineral acids—especially when used freely—are capable of absorbing the earthy substance of healthy bone, at least of that part of it which surround the diseased. Whether or not this is followed by an absorption of its organic substances we do not know. If so the bone may or may not be regenerated. Judging from the experiments gained by operations where bone is taken out of its periosteum, the former is probable. The only case that could give any hint in respect to decalcifying and absorption of healthy bone, is that of No. 4, where the manubrium was decalcified. There is up to this date nothing to indicate absorption of its cartilage. The manubrium is, however, not only an exceptionally slender bone, but is,

when separated from the drumhead, under abnormal nutritive conditions; nothing can therefore be concluded from this case.

The foregoing communication may be sufficient to show the efficacy of mineral acids, and especially of the muriatic acid, in necrosis of the temporal bone. That acids also may be useful in calcareous infiltrations of the drumhead and the mucous membrane of the middle ear, is more than probable.

REPORT OF CASES OF DISEASE OF THE MASTOID PROCESS. WITH REMARKS.

(ARTICLE III.)[1]

BY HENRY FERRER, M.D., SAN FRANCISCO, CAL.

CASE 20.—**Acute Purulent Inflammation of the Right Middle Ear, Accompanied by Intense Pain; Chiselling of Eburneated Mastoid; no Communication Obtained; Cure in Seven Months.**

Boz. Rad., male, forty-three years old, consulted me, October 14th, 1886, for acute purulent inflammation of the right ear, accompanied by severe pain. He had earache a few nights, applied home remedies until the ear began to discharge, but found no relief. Discharge muco-purulent, and not very profuse. After syringing and drying, *Mt* very much inflamed, and with a very small perforation through which pus oozed out. I enlarged the perforation freely downwards, inflated with Politzer, and, after drying carefully, applied a Priessnitz compress. That night he slept for the first time, but still had sharp pain at times. He came daily to my office until November 2d, being treated in the same manner; the discharge had decreased, and Priessnitz was dispensed with. Patient was seen on the 6th, 8th, and 11th. On the 15th he left for New York, against my advice. There was then scarcely any discharge, no pain, and the patient seemed to be recovering.

On his return, December 19th, he related, that during the journey his ear had again become so painful that on his arrival in New York, December 6th, he had consulted Dr. Roosa, who attended him for a few days, and informed him that possibly the mastoid

[1] Article I., these ARCHIVES, xvii., p. 308, etc.; Article II., these ARCHIVES, xviii., p. 25.

were involved. On the train from New York to San Francisco he had continuous pain, increasing greatly at night.

I found some muco-purulent discharge in the meatus; the latter was very much narrower by collapse of its upper wall, thus preventing good inspection of *Mt;* what could be seen of this was dark-red; upon inflation with Politzer (catheter could not be introduced on account of obstruction from deviated septum) a very small perforation was found. He complained of intense pain in the ear itself, over the mastoid region and shooting forward to the right orbital region. I at once performed paracentesis of that portion of *Mt* which was visible, inflated thoroughly, and applied Priessnitz. The mastoid region was neither swelled nor tender. In this way he was attended to daily up to December 31st. The pain at night gradually increased, but was almost absent during the day. January 1st I succeeded in keeping him at home, and applied ice to mastoid and warm baths to meatus continuously. The discharge from meatus still was very slight, and swelling of its walls was the same. January 13th and 14th, he had a very alarming night, becoming delirious and violent, so that his family became afraid of him. Upon his return from New York, and since then, I had advised opening the mastoid repeatedly, but he would not listen to it. With the kind aid of Prof. R. Beverly Cole, his family physician, I succeeded in convincing him, and operated January 15th; at this time, though somewhat sensitive upon strong pressure, the external integuments of mastoid were perfectly normal; the amount of discharge and the appearance of external meatus had not changed.

Operation: Drs. Beverly Cole and de Vecchi assisting. Ether narcosis by Dr. Whitwell. Incision in usual manner, 6 *cm* long, through the normal soft tissues; periosteum normal, well attached to the bone; external plate normal; *spina supra meatum* and canals for emissary vessels not well defined. I began to chisel in usual spot; I chiselled patiently through eburneated bone to a depth of 2½ *cm* before any air cells could be detected; I then came to what I supposed to be the antrum—a very small cavity running inwards and upwards. No signs either of pus or of any degenerated mucous membrane, and no communication was obtained. The chiselling process lasted 42 minutes, on account of the density and hardness of the bone. Dressed with iodoform gauze, bandaged in usual manner, antiseptically.

January 16th.—Felt very bright; had a very good night; bandage partly renewed.

January 17th.—Had considerable pain during the night; bandage renewed, all the gauze being removed from the bone and replaced. He was visited twice daily until February 1st; the discharge from meatus ceased entirely immediately after the operation; after inflation the ear was syringed with carbolized water. The bone soon began to granulate. February 11th he was allowed to go out, and called at my office to have a nail applied; this was over 2½ *cm* long. He still complained of some pain, but was able to attend to his business, and slept very well. From now on he was treated daily in the office. March 2d the nail was shortened; March 5th, shortened again; now 1½ *cm* long, kept in place by a headspring. In April he was treated daily. The lumen of external meatus normal, *Mt* pale-red, and thickened, $h = {}^{0.3\,5}_{1}$. End of April nail was dispensed with; by May 6th the fistula in the bone had closed perfectly. I did not see him again until the 21st, when he was dismissed.

The question now is, was the intense pain caused by disease of the mastoid, and was the operation justified? Similar cases have often been reported, cases in which it was expected that a diseased mastoid would be found, and in which this same eburneated condition, with neither purulent nor catarrhal affection of the cells, presented itself. Was this, possibly, a simple case of neuralgia of the mastoid, or was some part of the bone affected which was not reached by the operation (some of the horizontal cells) or which was inaccessible? I have no doubt whatever that any other aurists would have operated in the same manner; and the result speaks for itself. The collapse of the upper wall of meatus is almost a positive symptom of retention in the mastoid cells. The continuous intense pain and delirium certainly point to congestion of the meninges. It was difficult to decide whether the cell reached at a depth of 2½ *cm* was the antrum; it was too small and too deep to be positive of its contents. It is probable, however, that this was the antrum, for, in examining a large number of bones, I have found that the denser the bony substance of the mastoid the smaller the antrum, and that in cases of eburneation the latter even lies above the upper wall of the meatus, is placed horizontally, and is flattened, the inner plate being,

as a rule, thinner than one would expect. I possess a large collection of these bones, and whenever I look them over I cannot but ask myself how such an antrum could be reached by following the rules of Schwartze. It is probable that in all cases reported, in which after penetrating 2½ *cm* and over the operation was abandoned, such an antrum existed. The reason for keeping the nail of such length was, that certain portions of the bone would not granulate and remained rough.

CASE 21.—**Acute Purulent Inflammation of Right Middle Ear with Extensive Œdema of Head and Face; Subperiosteal Abscess; Empyema Mastoidei; Operation; Communication; Cure in Eight Weeks.**

Almada, aged fifty-three, Portuguese, came to the German Hospital February 8, 1887. For the last two weeks he has been treated in the country for facial erysipelas.

Status præsens: Patient is tall, poorly nourished, his head has been entirely shaved; he is a picture of distress. His entire head is swollen; eyelids cannot be separated; nose is so swollen that he keeps his mouth open for breathing; his lips are still more swollen, and the upper one is very dry. Swelling is more marked on the right than on the left side; thus the left auricle is slightly œdematous while the right is very much thickened. The right side of the scalp has also a different appearance, being almost purple in color. The nearer the right temporal region, the denser the swelling; it is most marked over the mastoid region—this feels hard and is very sensitive to pressure. The right meatus is almost entirely closed and contains a thin purulent discharge. Temperature, 38.6. I ordered him to be kept ready for operation, and his head to be washed with soap and carbolic solution.

February 9th, A.M.—Temperature, 38.4.

Operation: Dr. Morse assisting. External incision 5 to 6 *cm* long through the infiltrated, lardaceous, soft integuments which were 3 to 3½ *cm* thick. This diminished the tension, and was soon followed by copious parenchymatous hemorrhage, which stopped in a few minutes after compression with sponges. About one teaspoonful of pus escaped; the periosteum was detached from the bone upwards above the level of the auricle, and partially in the meatus. The surface of the external plate did not present any marked change and there was no fistula in the bone. *Spina supra*

meatum as well as emissary canals well defined. I then proceeded to chisel in usual spot, and after perforating the external plate which was 6 to 7 *mm* thick, I arrived at a cavity filled with pus. Scoops were now used, and though the bone was exceedingly hard, I penetrated to a depth of of 2½ *cm*. In syringing, there was very free communication. The cavity was filled with iodoform gauze, and an antiseptic dressing applied.

February 10*th*.—Temperature 37.4 A.M. ; 37.6 P.M. Slept well. Œdema of the face, especially on left side, considerably less; opens left eye with ease ; the purple discoloration of the head has also changed into a dark red (complexion naturally deep brunette). Bandage was removed on account of being saturated with blood ; gauze entirely removed from fistula. Syringed well with carbolized solution ; communication very free. Dressed and bandaged in usual way.

February 11*th*.—Temp. 37.2 A.M. ; 37.4 P.M. Opens right eye ; face now looks natural ; œdema of auricle and meatus much less ; discharge hardly noticeable. From this time on had no fever ; he was attended daily and treated in same manner. The fourth day after the operation he was allowed to sit up out of bed. The fistula began to granulate rapidly, so that March 5th I applied a conical led nail 2½ *cm* long, held by a headspring ; after this date he was treated daily in the office as an outdoor patient.

March 11*th*.—Nail removed ; is still almost 2 *cm* long. In a few days afterward the fistula closed entirely ; March 28th he was dismissed as cured. Meatus of normal width, *Mt* thickened, $h = \frac{c}{5}$.

To most specialists, the fact that patient had been treated for erysipelas would not seem astonishing. We had in this case a dense mastoid with a very thick external plate and with a very few air cells of large size communicating freely between themselves. The subperiosteal abscess was undoubtedly not a primary, but a secondary one, formed by gravitation of the pus along the posterior and upper wall of the meatus. This was also the cause of the intense œdematous infiltration of the whole right side of the head. The nail was left out though still 2 *cm* long, because the discharge from meatus had ceased, and the fistula in the mastoid had contracted so much after the nail had been left out for a few minutes, that its introduction was very painful and difficult.

CASE 22.—**Sub-Acute Catarrhal Inflammation of Right Middle Ear, with Purulent Inflammation and Retention of Pus in Mastoid Cells; Spontaneous Subperiosteal Perforation Outwards; Operation; No Communication; Recovery in Four Weeks.**

Ervine P——, male, three years old, contracted a severe cold five weeks ago. About this time he complained of his right ear, but not sufficiently to make him cry; in being washed he dreaded to be touched on the left side. He was kept in the house, and his ear covered with cotton. There was no discharge from the ear. During this time, the child's general health was poor; he lost considerable flesh, and looked very pale; during the day he was quite playful, but at night he complained about his ear, and was very restless. Whilst washing him, on the morning of February 18th, his mother noticed a swelling behind the ear, and she came to my office very much alarmed, remembering that her next door neighbor had lost the child, described in my last report as No. 15.

Status Præsens: Left auricle standing almost at a right angle; behind this is a diffuse swelling over mastoid, the skin covering which is still of a normal color. This swelling feels soft, and is very sensitive to pressure. External meatus perfectly normal. *Mt* of uniform red color. I applied a Priessnitz compress, and decided to operate the following morning.

February 19th.—Operation: Ether narcosis. Dr. de Vecchi assisting. Incision through mastoid swelling down to the bone; to my astonishment only a few drops of pus escaped, the swelling consisting chiefly of fungus granulations. The bone was denuded of periosteum, and its surface felt rough. At point of election the external plate was somewhat discolored, and a very fine fistula was found here. With a sharp spoon this external opening was enlarged, and the cavity carefully scooped out and syringed with carbolized solution, packed with iodoform gauze, and an antiseptic dressing applied. Narcosis excellent.

February 20th, A.M.—I found the boy dressed and playing; no fever; his whole appearance already much improved. I had him put to bed; renewed the bandage without removing the gauze from the wound.

February 21st.—Sleeps well, appetite good, wants to get up. Removed dressing entirely, no sign of suppuration. Rebandaged.

February 23d.—As yesterday, same satisfactory condition. Was allowed to get up.

February 24th.—First traces of pus, and formation of granulations in mastoid.

During the remainder of the month the boy was visited and treated at his home once a day. March 1st he called at my office, had a conical lead nail 2 *cm* long inserted and held with a spring. March 4th, nail shortened, and on 7th left out entirely, on account of irritation of skin. March 8th the fistula closed entirely, covered with sublimated gauze, and held by a spring. I saw him twice again, the last time on the 19th, when all bandages were removed, and he was dismissed as cured. *Mt* thickened, pale red; $h = \frac{0.0}{6}^{2}$ very much improved after inflating by Politzer.

I have seen the boy repeatedly since; *Mt* has remained dull, but his hearing is almost normal.

The principal feature in this case was the absence of discharge from the middle ear; it almost looks as though this were a case of primary purulent inflammation of the antrum and its continuations. No doubt there was, at first, an *otitis media catarrhilis acuta*, with an identical process in the antrum; but, for some unknown reason, suppuration took place in the antrum, and not in the middle ear. The absence of the very intense pain, which is usually present in cases of purulent retention in the cavum tympani, also supports this opinion. The means of ascertaining positively the presence of secretion in the tympanum—catheter and Politzer—were not applied at my first visit; but any large increase of secretion would certainly have been seen upon inspection. During the entire treatment there was neither earache, nor any other ill effects, caused by the injected fluid running into the middle ear.

CASE 23.—**Chronic Bilateral Otorrhœa in a Deaf and Dumb Child; Large Polypus in Each Ear, Producing Retention of Pus; Caries Mastoidei on Left Side, with Spontaneous Perforation Through the Bone and Soft Tissues; Operation; Communication; Cure.**

L——m, female, aged nine and a half years. Was brought to me February 6, 1887, with a swelling over left mastoid. The child is very robust, and is apparently in good health, an inmate of the Berkely Deaf and Dumb Asylum for the last year. When two

years old she had scarlatina, with diphtheria, during which both ears began to discharge ; they have been discharging ever since. Shortly afterwards the mother took the child to Chicago, and had the ears attended to by a physician, but finding no improvement after a few months she returned to her home in Denver. At that time the child had a small lump behind the ear, but this swelling disappeared afterwards. When about four years old, while trying to cross a railroad track, she was struck by a passing train, receiving a scalp wound and being made unconscious for one hour. At home the ears were attended to at intervals without any benefit ; and the mother, being satisfied that the child would never recover speech, moved to California, and placed her in the above-named asylum. Here also she attempted to have her child's ears treated, but was unfortunate enough to fall into the hands of a practitioner who advised her to do nothing, that the discharge from the ears was unpleasant, but not dangerous. In the asylum, the ears, which had a very fetid discharge, had been syringed daily, by order of the superintendent, Mr. Wilkenson. End of January a swelling presented itself on the left mastoid region ; a practitioner who was summoned opened this and evacuated very fetid pus ; a few days later the child was sent to me.

Status Præsens : From both ears very profuse, fetid, bright-yellow, purulent discharge.

Right Side : After syringing and drying, found the bony portion of external meatus filled with a large polypus. All means of testing the hearing gave negative results, with the exception of T. F., which was heard when applied to the bone.

Left Side : No hearing whatever ; chronic otorrhœa. A large polypus fills the entire external meatus. The meatus is of normal width ; no swelling of its walls. A considerable swelling over mastoid region, which presents a small fistulous opening, clogged with granulations at the level of the upper wall of the external meatus. The skin over the swelling was purple and fluctuating ; upon pressure, pus would ooze out of the fistula. The child was sent to the German hospital, with proper directions for disinfecting and shaving, so as to be in readiness for operation the following morning.

February 7th.—Operation : Drs. Morse and de Vecchi assisting. The child having been etherized, I began by snaring off the aural polypi. Incision in usual manner, taking in the fistula. A large number of fungous granulations were first thoroughly removed by

scooping. Quite an amount of pus escaped during the incision; hemorrhage was very slight. The external surface of the bone was rough, and about 2 *cm* from posterior wall of meatus a fistula was found, in which a director could be introduced through soft masses to the depth of over 2½ *cm*. The fistula was enlarged by chiselling, and the atrophied external plate snipped off, as far as undermined, with Luer's sharp bone forceps. There then presented itself a large cavity filled with an extremely thick, fetid, cheesy substance; this was scooped out to the dept of 2 to 2½ *cm*. In syringing either way, very free communication existed. The cavity was packed with iodoform gauze, and an antiseptic bandage applied.

There was no reaction whatever; the child had no fever; she was kept in bed two days, treated and bandaged daily. The third day she was allowed to walk in the garden. February 12th, left the hospital; after this she called daily at my office.

February 13th.—The bone was granulating so fast that a nail had to be applied; the discharge had lost its fetid odor, and was very trifling; it increased with the formation of granulations, and decreased with the insertion of the nail. As injections, 2½-per-cent. solutions of carbolic acid were used.

March 4th.—The child has been attended daily. There are no granulations visible in the middle ear, the mucous membrane, though succulent, is pale. The end of the nail can be seen through the meatus; it is no longer in the cavum tympani, but has been displaced into the inner portion of the meatus by caries. The meatus being abnormally wide, the discharge scanty, the nail cavity no longer communicating with the middle ear, and no denuded bone being felt, the nail was left out altogether. In a few days the nail cavity had closed, leaving a depression externally. The membrana tympani is entirely destroyed, and no ossicles are visible.

Right side: The polypus was removed when the left side was operated upon. This ear was also treated daily with injections of carbolized water. The remnants of the polypus, which were found to proceed from the roof of the middle ear, were repeatedly cauterized with chromic acid. On this side also there was total absence of *memb. tymp.* and ossicles, the mucous membrane being in same condition as in the fellow ear. The suppurative process yielded readily to this treatment; the discharge, which at first was profuse, purulent, and fetid, became scanty, muco-purulent, and

only moistened the inner end of the cotton plug which filled the meatus.

In this condition the child was taken away by the mother, with the proper appliances and directions to syringe the ears once a day with carbolized water.

October 6th.—She returned with a very profuse, fetid, purulent discharge from both ears. The child had been neglected, for I removed from the bottom of right meatus two, and from the left three, plugs of cotton impregnated with decomposed matter. I syringed thoroughly with a solution of sublimate $\frac{1}{2000}$; after drying, I found the epidermis of the bony portion of both meatus macerated, but, strange to say, no visible change in the middle ears. Boric-acid powder, and then cotton, were applied to the meatus.

October 7th.—Very little discharge, almost inoffensive, less on left than on right side. Carbolic solution used for injection, boric-acid powder for walls of meatus.

October 8th.—Still less discharge. Walls of meatus still red, denuded of epidermis. The mother was provided with a suitable powder-blower, and instructed never to apply the powder until the ears had been carefully syringed. The child returned to the deaf and dumb institute, and is to be brought once a week for inspection.

October 29th.—I found four pieces of cotton filling the entire left meatus; they were dry, and there was no discharge perceptible. In the right ear no discharge, some dry boric acid. Advised the same treatment to be continued, but only twice a week, and to bring the child again should the discharge make its appearance.

November 10th, 1888.—I have not seen the child again, but I have been informed repeatedly that she is in the institution, and has had no more trouble with her ears.

Case 24.—Acute Purulent Inflammation of Left Middle Ear; Empyema Mastoidei; Spontaneous Subperiosteal Perforation; Operation; No Communication; Cure in Three Weeks.

Albert C——, aged six and a half, was brought to me by his mother, April 1, 1887, with otorrhœa of left side and swelling of mastoid region.

The child was well nourished, and healthy. Seven weeks previously, without known cause, had had a purulent discharge from

the left ear; this had been treated with injections of water and tea; on the day of consultation a swelling presented itself behind the ear.

Status præsens: Left side, auricle normal; copious muco-purulent discharge from meatus, the walls of which are swollen. After cleansing and drying *memb. tymp.* injected, a small, pulsating perforation visible. The mastoid region swollen, integuments red; very painful to touch.

April 2d.—Operation: Dr. X. Scott, of Cleveland, assisting. Incision through swollen portion of mastoid down to the bone, emptying some pus from a subperiosteal abscess. The external plate denuded of periosteum, and here was found a small fistula. The latter was enlarged with chisel and hammer, exposing a cavity in the mastoid process filled with pus. This cavity was scooped out to a depth of 2 *cm.* Injections with carbolized water used, and no communication obtained. Dressing with carbolized gauze and antiseptic bandage.

April 3d.—Bandage and a portion of the packing in the wound renewed; no discharge from meatus.

April 4th.—Same condition as yesterday; dressing renewed; no discharge.

April 5th.—Could no longer keep in bed. Granulations begin to form. He was treated in the same manner until April 12th, when he called at the office and had a lead nail 2 *cm* long inserted.

April 16th.—The mastoid has filled up with granulations so rapidly that it is hard to keep the nail in; there is no discharge from meatus, no perforation visible, and the *Mt* is only slightly injected; the nail was removed. The fistula, which contracted rapidly, was kept covered with sublimated gauze, held by the spring. The mastoid was washed with carbolized water every other day.

April 23d.—The nail bed had closed entirely.

April 27th.—Fistula closed, leaving a linear scar; was advised to wear cotton in the ear for a few weeks.

November 7th.—Has not had any trouble with his ear since; looks well and robust. In mastoid a linear scarcely depressed scar. *Memb. tymp.* still somewhat dull and thickened; $h = \frac{0.9}{6}$.

CASE 25.—**Acute Purulent Inflammation of the Right Middle Ear; Empyema Mastoidei; Subperiosteal Ab-**

scess by Gravitation; Operation; No Communication; Cure in Three Months.

Antonio Silva, fifty-four years old, a Portuguese, consulted me May 6, 1887, and gave the following history: About six weeks ago he was working in a field, when towards evening he was taken suddenly with a severe pain in his right ear, lasting all night and the following day until the ear began to discharge. He then went to Sacramento, where he was under the care of an aurist for one week. Finding no relief he came to San Francisco, and placed himself under the care of another aurist for the next three weeks. The pain in the ear has never left him entirely; the discharge has been very profuse. During the past few days the pain increased, and his neck and ear began to swell; the discharge has remained the same. Patient was never sick before; he is now very much emaciated.

Status præsens: Auricle standing from the head, its posterior surface swollen; the meatus filled with bright green pus; its walls so much swollen that no view of *memb. tymp.* can be obtained. The mastoid region presents a diffuse swelling, extending backwards into the occipital region and downwards into the neck. The swelling over mastoid is of dark-red color, feels hard to the touch, and is exceedingly painful. Upon inflation with Politzer the air passes freely; râles and perforating sounds are heard. I sent him at once to the German hospital, with the directions to give him a bath, to shampoo his head, and to shave the temporal and mastoid regions.

Patient would not submit to an operation; was kept in bed, Priessnitz compress, the meatus syringed two or three times daily with carbolized water. He had so much pain during the nights of the 6th, 7th, and 8th, in spite of opiates, that he decided to be operated upon.

May 9th.—Operation after Schwartze; ether narcosis. Incision 6 *cm* long through the infiltrated tissues, which were 2½ *cm* thick, The periosteum detached not only from the mastoid process, but also from the posterior wall of external meatus in its entire length; this was ascertained by the introduction of a probe emptying some pus. External plate somewhat rough; no fistula. *Spina supra meatum* and emissary canals well defined. In the situation of the latter, the so-called spot of selection by Schwartze, I began to chisel. After penetrating 3 to 4 *mm* greenish pus began to ooze out profusely. Upon probing I found the mastoid transformed into

an abscess ; the external wall of this was chiselled to a width of 2 *cm*, and the cavity scooped out to a depth of 3 *cm*. The hemorrhage was comparatively small. No clear communication was obtained in syringing. Dressed with iodoform gauze ; bandaged antiseptically.

May 10*th*.—He had some pain during the night ; no opiates ; no fever ; his general appearance is much improved ; the bandage is saturated with blood ; the gauze in the meatus saturated with pus ; the gauze in mastoid partially renewed ; bandaged in same way.

May 11*th*.—He had no pain, slept all night, this being his first good night since the beginning of his ear trouble. Very little pus was found in the meatus, none whatever in the wound. The gauze is firmly adherent to the edges of the wound. Syringed with 2-per-cent. carbolized water. Usual dressing.

May 12*th*.—Same condition as yesterday ; he was allowed to get up.

May 13*th* to 16*th*.—Discharge has almost entirely ceased, only the inner end of the cotton pellet filling the meatus has traces. He has been treated daily in usual manner.

May 16*th*.—He leaves the hospital to be treated at my office. The mastoid begins to granulate nicely, and consequently the discharge from the same has increased. Same treatment.

May 26*th*.—He has been attended daily in usual manner ; the discharge from mastoid still profuse, and the fungous granulations required reduction by cauterization with nitrate of silver on several occasions. The cavity is lined with granulations except above where the bone is still denuded and rough. The granulations not yielding to silver, they were cauterized to-day with a saturated solution of chromic acid. There is no discharge from meatus ; its walls have returned to a normal condition. The *membrana tympani* appears thickened and is still injected ; no perforation visible. With the catheter, the tube is found wide open, no râles or perforating sound audible.

June 1*st*.—The granulations have yielded nicely to the chromic acid ; their discharge is very much less. The inner end of cotton pellet in meatus impregnated with fetid pus. The catheter was used daily with same result, no râles or perforation audible. No fistula can be seen in upper wall of meatus or in *membrana flaccida*.

June 10*th*.—A conical nail 2 *cm* long was inserted.

June 13th.—Since the application of the nail the discharge has diminished very much ; the nail was reduced 2 *mm.*

June 18th.—The nail again reduced in size.

July 13th.—The nail bed still 2 *cm* long, granulations sluggish ; no tendency to contract after the nail had been removed for a few minutes. The nail was removed and pure sulphuric acid applied to its bed with a cotton holder.

July 14th.—Secretion has not increased by the application of sulphuric acid. Nail bed very much contracted ; cotton holder still shows a depth of 2 *cm ;* it was swabbed out well with 5-per-cent. solution of carbolic acid, covered externally with sublimated gauze and spring. During the month patient was attended to, in this manner, every other day. The discharge from the fistula exceedingly small, but yet a fine probe could be introduced to a depth of 1 to 1½ *cm.*

August 1st.—The fistula in mastoid has closed entirely ; it was covered with a piece of court-plaster.

August 5th.—Fistula remained closed, no signs of retention of pus nor pain upon pressure. *Mt* is thickened and slightly red $h = \frac{c}{s}$. Patient dismissed.

Case 26.—Acute Catarrhal Inflammation of the Right Middle Ear, Ending in Purulent Form with Incarceration of Pus in an Eburneated Mastoid; Operation; Cure in Less Than Three Months.

De K——, male, twenty-two years old, from New York ; consulted me May 5, 1887, for otalgia of right side, which began two weeks previous, and for which he had been treated by a physician without relief.

Status præsens : Right side ; auricle and meatus normal. *Memb. tympani* evenly injected, copper-colored, no visible signs of exudation in middle ear. Mastoid region normal, no pain upon pressure. $h = \frac{c}{s}$. With catheter I found the *tuba* open, no râles, infiltration produces no improvement of hearing. For the last two weeks his sleep has been interrupted by sudden pains in the head, chiefly in the occipital and temporal regions. Moist dressing applied.

May 9th.—He has been treated daily with inflation of middle ear and Priessnitz' compress. He has had very severe pain during the nights, but was relieved during the day. The early part of last night the pain was very severe, but passed away after the ear began to discharge.

May 14th.—He has been treated daily with inflations, injections of carbolized water and Priessnitz. Upon syringing, the fluid passes freely into the nose. The discharge is very copious and entirely purulent, necessitating the frequent change of the cotton pellets.

May 30th.—Same treatment daily. He has had more or less pain during the night, but none during the day. Discharge unchanged. The mastoid region does not show any signs of inflammation, but is painful upon pressure. The meatus is perfectly normal, *memb. tympani* is injected, with a pulsating perforation in its lower anterior segment. Schwartze's nitrate of silver treatment was used, but being followed by increased pain and suppuration, was not tried a second time.

May 30th to *June 6th.*—He became very much worse, the discharge being so copious that he had to be treated twice a day. The pain had also increased; he complained of continual headaches day and night, spells of shooting pains. He had slight fever; his tongue was coated; he had no appetite: complexion yellowish.

June 6th.—Operation in German hospital, Dr. Morse assisting. The soft parts covering mastoid normal; incision 1 *cm* from and parallel with posterior insertion of auricle, 5 to 6 *cm* long; periosteum normal, well attached to the bone, external plate normal; emissary canals well defined, *spina supra meatum* very prominent. I began to chisel in spot of selection, and after penetrating 1½ *cm* through dense, healthy bone I came to a few drops of pus. The external opening was enlarged to 1½ *cm* and then the scoop used until a depth of 2 *cm* was reached. Upon syringing, slight communication existed. Dressed as usual, packing the wound with iodoform gauze; antiseptic dressing. In the evening, temperature 38° C.

June 7th.—Temperature 37°. He had very little pain and slept part of the night. The bandage soaked with dry blood. Very little discharge on cotton pellet in the meatus. The gauze in the wound was firmly adherent and therefore not disturbed, but was well saturated with carbolized water by syringing.

June 8th.—Last evening temperature 38°, this morning 37° C. Patient feels and looks much better. He was able to go into the garden. Renewed bandage and a portion of the gauze in the mastoid. No discharge from the meatus.

June 12th.—He has been treated daily at hospital; to-day he

calls at my office for the first time, to be treated as an out-door patient. The wound begins to granulate and there is very little discharge from the mastoid, none from the meatus.

June 16th.—No discharge from the meatus since June 8th; *memb. tymp.* appears dull red; $h = \frac{0.0}{8}$. The external wound closing rapidly, but no signs of granulations in the bone, the cavity packed with iodoform gauze, covered with sublimated gauze held by a headspring.

June 24th.—The granulations in the cavity of the bone are forming slowly; they are stimulated by cauterization with a solution of nitrate of silver.

June 27th.—The granulations in the cavity have formed nicely, but several denuded spots can still be felt. Same treatment daily.

July 4th.—The external wound, as well as the cavity, almost totally filled with fungous granulations, bleeding freely at slightest touch. Applied a conical nail 2 *cm* long.

July 5th.—The nail has reduced suppuration and formed a nice bed for itself. Syringed with carbolized water. $h = \frac{0.2}{8}$.

July 6th.—The nail bed 1½ *cm* deep, contracts readily when the nail has been left out a few minutes; for this reason the nail was removed.

July 9th.—The discharge has again increased very much; after cauterizing with nitrate of silver the nail was reinserted.

July 13th.—The nail bed again 2 *cm* deep. Patient being very desirous of going home, another attempt was made to leave the nail out.

July 16th.—Almost no discharge; the fistula has contracted so that only with a fine probe can I penetrate 1½ *cm*. Daily swabbing with 5 % carbolized solution by means of cotton holder.

July 21st.—Fistula entirely closed; linear scar with almost no depression of external plate, no special pain upon pressure. Dismissed and leaves for Washington.

December 3d.—I have received several letters from patient stating that his ear is in perfect condition.

CASE 27.—**Chronic Purulent Inflammation of the Right Middle Ear with Total Destruction of Memb. Tympani; Caries Mastoidei with Abscess; Spontaneous Perforation of External Plate; Large Subperiosteal Abscess; Operation; Communication; Cure in Seven Months.**

Alfred K——, male, twelve years old, first seen July 20th, 1886. I find in my Case-book: "When one year old patient had

an abscess behind the right ear, but positively without any discharge from meatus. The abscess was opened and treated by Dr. Tolandsen. At present a funnel shaped depression over right mastoid, *memb. tympani* irregular and very much thickened. Fetid purulent discharge from left side, *memb. tympani* almost entirely destroyed, only the *membrana Shrapnelli* existing. In the inner portion of meatus a large granular polypus starting from lower part of middle ear." He was treated regularly in the office during the following ten days in August, at an average of every second day, to the 16th, when the suppuration had ceased entirely and no traces of the polypus were left. On the 31st of August he was seen again, and being perfectly well, was dismissed. During this period the treatment consisted of injections with carbolized water; the bulk of the polypus was removed with the cold snare, the remnants by cauterizations, either with nitrate of silver or with chromic acid.

June 1st, 1887, he called again with a relapse of the suppuration on left side; after cleansing and drying there were no signs of granulations, the walls of the middle ear as far as visible being covered with a shining serous-like lining; no denuded bone felt by probing. This aroused my suspicions as to the source of the profuse discharge, and though the mastoid region seemed perfectly normal externally, I cautioned the mother to attend the case carefully, since probably the bone was affected.

June 22d, he was brought to me with his head all bundled up in shawls, and the mother gave me the following information: She attended to the boy's ear as directed. On June 18th he felt sick at the stomach and vomited several times; at the same time he complained of headache and pain behind the ear. At first the family physician treated him for indigestion, but his attention being called to the ear, and finding some swelling, he ordered poultices.

Status præsens: The left auricle is swollen and stands out; behind this is a large fluctuating abscess ready to break, occupying the whole mastoid region and extending backwards into the occipital region. The skin covering the abscess is of purple color. From the meatus flows fetid, yellow pus. The walls of the meatus are somewhat swollen. The boy's general health has been very bad lately, he has lost flesh and bears upon his face the signs of great suffering. I opened the abscess at once by an incision 3 to 4 *cm* in length, emptying about three tablespoonfuls

of fetid, yellow pus, mixed with caseous masses. Then, by syringing profusely with carbolized water, more caseous substance was removed. By probing, the surface of the bone felt rough, but no fistula could be found, nor was any communication with the meatus noticed. A drainage tube was inserted and an antiseptic dressing applied.

June 23d.—He slept well last night and feels much better to-day. The discharge has diminished greatly. The bandage is partly saturated with blood. Syringed with carbolized water. The operation was postponed until June 30th, so as to allow the boy to gain strength.

June 30th.—Syringed and dressed daily; boy sent to the German hospital where his head was disenfected and the temporal region shaved.

Operation: Dr. Morse assisting. Incision 3 to 4 *cm* long through the infiltrated integuments. The surface of the bone is exceedingly white, and at the spot of selection there are some fungous granulations. Probing through this granular substance I could penetrate into the bone. I began to chisel around this fistula, making an external opening of 1 *cm* in diameter, I scooped out a great quantity of cheesy substance, penetrating about $2\frac{1}{2}$ *cm.* There was considerable hemorrhage from the bone substance. In syringing, very free communication was obtained. The cavity in the bone filling with blood as rapidly as it could be sponged out, and though the hemorrhage ceased after using compression with a sponge, the cavity was filled with a clot of blood. This was left undisturbed, iodoform sprinkled on the wound and usual antiseptic bandage applied.

July 1st.—Patient slept well all night; the bandage found saturated with blood, it was renewed. The opening in the bone still filled with coagulated blood which was left undisturbed to avoid hemorrhage. The cotton pellet in the meatus is somewhat impregnated with pus and blood. No fever. He leaves the hospital.

July 2d.—He came to the office for treatment; the ear and the mastoid in same condition. Same treatment without any especial change until

July 8th.—For the first time after the operation, in syringing through the meatus, complete communication with the mastoid is obtained. The mastoid is granulating nicely, consequently suppuration has increased.

July 9th.—I adapted a conical lead nail 33 *mm* long, held by a headspring.

July 7th.—He has been attended to daily; as early as the 14th there was no discharge in the meatus. To-day, for the first time, he became very dizzy when I syringed, and after recovering from this, also when the nail was introduced. The nail was then shortened 3 *mm.* In syringing, which had to be done very cautiously, the communication was at times interrupted; at times again it was perfectly free. The amount of discharge was exceedingly small, but had a peculiar putrefactive odor. I often tried to detect some necrosed portion of the bone by probing, but never succeeded. This condition lasted during the whole of August, during which month he was treated daily with large injections of carbolized water, and the nail bed was occasionally cauterized, whenever communication was not very free.

September 3d.—The nail was reduced from 2½ to 2 *cm* in length, as the discharge was now scanty and no longer fetid.

September 9th.—No discharge; no communication in syringing.

September 12th.—Some discharge in the meatus; the nail-bed was cauterized with nitrate of silver.

September 13th.—Communication re-established and aluminium nail 2½ *cm* long adapted.

November 1st.—During October the case has been attended to daily communication maintained. Large quantities of carbolized water pumped through either by my assistant, Dr. E. S. Clark, or by myself. The aluminium nail was dispensed with, and replaced by a lead nail 1½ *cm* long.

November 7th.—No more communication with middle ear and no more discharge in the meatus. After syringing with the usual carbolic solution, the nail-bed was swabbed with 5-per-cent. solution of carbolic acid. The walls of middle ear covered with a fine smooth membrane.

November 15th.—Nail removed permanently. The fistula, after cleansing, covered with sublimated gauze.

December 23d.—He has been attended to three times a week; the fistula has contracted but still a fine probe can be introduced 1½ *cm.* In 56 hours hardly one drop of pus on the gauze. The fistula was swabbed with 5 % solution of carbolic acid. This treatment had to be continued twice and three times a week until January 28th, when no more traces of the fistula being found, he was dismissed cured, there being but a very slight depression on the mastoid.

CASE 28.—**Chronic Purulent Inflammation of Both Middle Ears with Caries and Abscess of the Right Mastoid; Operation; Cure of Mastoid Affection in About Four Months, Leaving Some Otorrhœa.**

Willie S——, male, four years old, called April 8, 1887, with chronic otorrhœa. When two years old the boy could hear and articulate plainly; then both ears began to discharge. He was taken to an aurist in this city and treated by him daily at his office; the treatment consisted of blowing powder into the ears, often without previously examining or syringing them, and occasional inflations by Politzer's method. The child became very much worse, and lost speech for several months.

Status præsens: Copious, fetid, purulent discharge from both ears. Meatus as well as mastoid regions normal. Condition of *memb. tympani* was not noted. He speaks so indistinctly that he is understood by his mother only. I ordered the ears to be syringed twice daily with tepid water and then instillations of a 2 per-cent. solution of Calvert's No. 1 Carbolic Acid. The parents became convinced by July that they could not succeed and, as originally advised, brought the child to me for daily treatment. During July I treated the child daily by inflations with Politzer and thorough syringing with carbolized solution. This was of no benefit whatever; the general health of the child was getting worse, he was restless at night, mastoid region on left side, though of normal appearance, was sensitive to touch; discharge from both ears, but more so from the left, which had increased and was exceedingly fetid.

July 28th.—Operation on left side, at the German hospital. Ether narcosis. Head disinfected and temporal region shaved. Incision through normal tissues to the bone, periosteum firmly attached to external plate which was normal. I began the operation with chisel and mallet, and at a depth of 5 *mm* I found pus. After sufficiently enlarging the external orifice, the scoops were used to evacuate the cheesy substance and pus contained in mastoid. In syringing, free communication existed. Dressed with carbolized gauze and antiseptic bandage. One half hour after the operation the child, wrapped up in blankets, was removed to his residence, a few blocks from the hospital.

July 29th.—I called at the house and found the boy running about. A marked improvement was noticed in his complexion, he slept well all night and never complained of pain. The band-

age was partly saturated with blood; it was removed. Scarcely any discharge from meatus, the cotton pellet being only partly impregnated. The gauze in the wound firmly adherent as usual, was left; syringed with carbolized water and antiseptic bandage applied.

July 30th.—Same condition and treatment as yesterday. The child is to be brought to my office and treated as an out-door patient. During the following five months he was treated daily. A few days after the operation the mastoid began to granulate nicely. Communication existed constantly; when slightly obstructed the necessitating the insertion of a lead nail *2 cm* long early in August nail-bed was cauterized with pure nitrate of silver. The discharge from middle ear never disappeared entirely, but lost its fetid odor. *Membrana Tympani* was entirely destroyed, the *membrana Shrapnelli* and the somewhat shortened handle of malleus still present. November 7th, the cutis covering the mastoid becoming very much inflamed and painful, so that the nail could only be introduced with difficulty, I decided to remove the latter entirely. The fistula in mastoid closed very rapidly, the inflammation of the skin, probably was only caused by irritation of the nail, subsided, and only a slight depression of the external plate and a linear scar remained. The discharge from the middle ear was scanty, muco-purulent and not fetid, the cotton pellet left in position for forty hours would show only traces of pus. In December he was seen daily, chiefly for observation; finding every thing satisfactory he was allowed to be removed to Garden City, Oregon. The mother had become experienced in using Politzer's method, and in syringing the ear; provided with all the necessaries, she promised to carry out the treatment, daily using carbolized water for the syringing. The right ear had also been treated; the condition of *memb. tympani* was alike in both ears, no granulations having ever been observed. The discharge decreased, lost its fetid odor when daily syringed, but became so when neglected for forty-eight hours—this being done occasionally for experiment.

July 2d, 1888.—The child was brought down again for inspection, and because the discharge from the right ear had increased. The left ear also suppurates more, the pus being very dark and fetid; mastoid in good condition. I treated the child ten days, during which period he improved so rapidly, that he was allowed to return home July 19th. He speaks a little more indistinctly. Watch of 5 *m* hearing distance is not positively heard upon pres-

sure either on meatus or mastoid, both sides being equal. This patient will figure again as Case No. 44 of the series of 1888 for operation on the right side.

This case will furnish the enemies of the boracic acid treatment another instance in support of their opposition. Without considering the pros and contras in the use of Bezold's remedy, I cannot help accusing of ignorance or negligence any specialist who will treat a purulent otorrhœa merely by inflating and filling the meatus daily with the powder, often even without convincing himself of the condition of affairs. This certainly was never done by Bezold, without previously carefully examining the condition of the powder remaining in the inner portion of the meatus. Similar treatment was applied by the same specialist in Case No. 12 of my first series (These ARCHIVES, XVII., p. 308, etc.) which ended in caries of mastoid.

CASE 29.—**Acute Purulent Inflammation of the Right Middle Ear; Empyema Mastoidei; Operation; No Communication; Cure in Five Months.**

A. A——, male, thirty-five years old, called at my office July 29, 1887, having severe pain in the right ear, which had begun one week before. I found the *membrani tympani* inflamed and bulged outward. I performed paracentesis at once, emptying a considerable amount of pus. After syringing with carbolized water, Priessnitz was applied.

July 30th.—He had a fair night, without any pain. There was a very profuse purulent discharge. Inflation proving that the perforation was very small, I enlarged the same. In syringing, the fluid then passed through the nose freely. The same treatment was carried on once a day, without any marked change, until August 4th, when the discharge increased so much that the ear had to be dressed twice a day. From August 4th to the 19th, the perforation had to be enlarged several times; he was treated twice a day; he complained repeatedly of having pain during the night. The mastoid region became sensitive to the touch, though not swollen; the walls of the meatus were normal.

August 19th.—Patient is very much discouraged, feels very weak, his appetite is poor, his tongue coated, his complexion yel-

lowish, he has slight fever. He was sent to the German hospital, and prepared to be operated upon the following day.

August 20th.—Operation: Section in ordinary way through the normal external integuments. Periosteum was adherent, and was pushed aside; external surface of the bone normal. *Spina supra meatum*, as well as the canals for emissary veins, well marked. After penetrating with the chisel through a hard external plate 5 or 6 *mm* in thickness, I reached a soft dark-red substance, the degenerated swollen mucous membrane, in two air cells of medium size. These were scooped out, and, penetrating still deeper, I found a cavity containing thick yellow pus. In probing, I found this cavity to be very large, and to extend so far backwards that I feared the sinus might already have become exposed. The cavity was scooped out very carefully, no pressure being used, and was afterwards irrigated thoroughly. When patient had almost recovered from the narcosis, a forced injection through the meatus was tried, but no communication was obtained. Finally, the cavity was again carefully syringed with a stronger solution of carbolic acid, and packed with iodoform gauze; antiseptic dressing.

August 21st.—The dressing was renewed by the house surgeon without my consent. Patient had neither pain nor fever. His complexion is whiter.

August 24th.—He has been treated in the hospital daily. Forty-eight hours after the operation he was allowed to get up. The discharge from the middle ear has ceased entirely. To-day he came to my office to have his wound dressed.

August 30th.—The cavity is almost entirely filled by granulations, and the external opening is getting so clogged by the same, that a conical lead nail 2½ *cm* long had to be inserted.

September 5th.—All through August he has been treated daily; there has not been much change, and communication has never been obtained. Yesterday he had some pain in the ear, and, for the first time, some discharge was found in the meatus. The *membrana tympani* is thickened and injected in its upper part and along the handle, but no perforation is visible nor detected upon inflation. In the nail-bed, at a depth of 2½ *cm*, a rough spot in the bone can be felt. The granulations bleed easily.

September 9th.—No discharge in the meatus since yesterday; the nail was shortened 3 *mm*.

October 1st.—During the month of September he has been treated daily. The last few days the skin covering the mastoid had

become inflamed and painful; the nail was, therefore, removed; to-day, after cauterizing the nail-bed with nitrate of silver, it was filled with iodoform gauze. These cauterizations were used three times this last week; on other days, daily swabbing with a 5-per-cent. solution of carbolic acid.

October 7th.—There is hardly any suppuration from the mastoid; the fistula is very much contracted.

October 14th.—The fistula has been cleansed daily with 5-per-cent. solution of carbolic acid. To-day it is almost closed; with a very fine probe I can still penetrate 1½ *cm.*

October 27th.—During the month of October up to the 18th, he was treated every other day, the fistula being cauterized several times, as already stated. To-day the fistula is entirely closed, no opening being found at all with a fine probe. It was covered with court-plaster, and patient dismissed.

January 4th, 1888.—He has had no more trouble; the *membrana tympani* is somewhat thickened; $h = \frac{1}{4}$. The linear scar on mastoid has a slight depression in its centre.

Case 30.—Pistol Wound of the Right Ear Producing Cicatricial Closure of Cartilaginous Portion of the External Meatus and Displacement of Auricle; Caries of Mastoid; Operation; Cure with Permanent Fistula Replacing the External Meatus; Extirpation of a Large Portion of Maxilla Inferior with Satisfactory Results.

George M——, male, in the thirties, shot himself with a revolver behind the ear, February 11, 1887, with suicidal intent. He was taken to the City Receiving Hospital by the police, treated, and operated upon March 3d; pieces of the bullet were removed. May 28th he was admitted to the German Hospital, operated by Dr. Morse June 4th, necrotic pieces of the upper maxilla being removed. Shortly after this last operation Dr. Morse requested me to see the patient; I found him in the following condition: Right auricle inclined backwards, almost horizontal, and contracted by complete cicatricial closure of the external meatus; in front of the tragus and at posterior insertion of the auricle are scars from previous operations. The meatus is entirely closed, forming an irregular slit, in the lower part of which a fine probe can be introduced 1½ *cm* in an upward and forward direction. In raising the auricle the posterior surface of which is in close contact with surface of mastoid, I find at its posterior insertion an

irregular cicatrix with a fistulous opening clogged with granulations in its centre. Pus is continually oozing from this and keeping the parts moist and raw. A probe introduced in the fistula takes the same course as the one in the meatus; but the two do not come in contact. No caries of the bone is detected.

Our intention was to separate the auricle entirely, to try to obtain communication with the external orifice of the meatus, and, answering to the patient's wishes, to give the auricle a better position.

July 22d.—Dr. J. Morse operated, I assisted. The first incision parallel to the insertion of the auricle was, like this, almost horizontal; all attachments were divided, and the auricle became perfectly movable. The irregular scar was excised by two other incisions running from each end of first incision and meeting downwards and backwards. Thus a triangular piece was removed, with the base at insertion of auricle and apex downward. In probing the external meatus, I found I had communication with its inner portion, and proposed to keep it open during the healing process of the wound, and later on gradually dilate it mechanically. It was therefore packed with iodoform gauze, and the doctor then applied stitches to bring the auricle into a more normal position. This was done by holding it in position and stitching the corresponding points, endeavoring to use traction upwards. The primary result was beautiful: the auricle was very much improved in position, the patient being no longer ashamed to keep it uncovered.

My efforts, however, failed to keep the external meatus open. This was attempted the first few days with iodoform gauze, then with a piece of a French soft rubber catheter, and finally with a lead nail. The wound healed, with the exception of its lower portion, from which some dark purulent discharge oozed out. Upon inflation, no air escaped through the posterior fistula, though the meatus was entirely closed. Patient complained continually of severe pain in his head, especially when eating. He threatened to take his life unless another operation were performed. I suspected the mastoid to be affected, especially as in probing some denuded bone could now be felt.

August 25th.—Mastoid operation; Dr. Morse assisting. Incision in usual manner running through the fistula, and soft parts. The granulations at orifice of fistula were first scooped out, and this was then enlarged with a chisel. The mastoid was found full

of granulations, which were thoroughly scooped out, producing considerable hemorrhage. I had penetrated 3 *cm*, until finding hard bone substance, I desisted from further procedure. The cavity was irrigated well and packed with idoform gauze. He was treated daily in usual manner, and the discharge ceased immediately.

September 4th.—A conical lead nail 2½ *cm* long was applied. The nail had an unusual course, running forward and upward, and was kept in place by a linen tape.

September 16th.—Discharge very slight ; nail reduced to 2 *cm* in length.

October 9th.—The nail could not well be kept in position ; it became troublesome by constantly falling out, and was replaced by a piece of French soft rubber catheter. Suppuration was very slight, becomes very fetid if not attended in forty-eight hours. To-day the external orifice is 6–7 *mm* in diameter, gradually decreasing while running upwards and curving in towards the osseous portion of the meatus. The walls of the fistula have no tendency to contract, are smooth as if covered with epidermis, and no rough places nor granulations can be detected by probing. In this condition patient left the hospital, perfectly satisfied.

February 14th.—He called on me, and was very much depressed mentally. He has not felt perfectly well since he left the hospital. A few days ago a swelling was noticed in front of the right ear, which opened spontaneously under the lobulus, emptying very fetid pus. He has pain in that ear almost every night, and is very much annoyed by the continuous noises in his head. I found under the lobulus, below the fistula in the mastoid, which was kept open by the piece of catheter, a second opening 1½ *cm* distant from the first, from which very fetid pus oozed. He was at once sent to the hospital to consult Dr. Morse ; the latter diagnosed caries and necrosis of maxilla inferior.

On February 17th, a large portion of the right inferior maxilla was removed by Dr. Morse. A few weeks later the patient was discharged cured. Careful examination during the narcosis showed that the fistula in the mastoid had taken the place of the external meatus ; this was arrived at by calculation, as inspection was not possible. This fistula communicated with the osseous portion of the meatus near the insertion of the *membrana tympani*, which was either destroyed or had a large perforation. In injecting a solution of chloride of sodium with the catheter for experi-

ment, the fluid, and also, upon inflation, the air, passed so freely through the fistula, that I was led to suppose that no *membrana tympani* existed, or, if present, had a very large perforation.

Case 31.—Chronic Purulent Inflammation of the Right Middle Ear with Acute Relapses and Formation of Subperiosteal Abscesses by Gravitation; Caries of the Mastoid; Operation; No Communication; Cure in Three Months.

Lily B——, female, aged eighteen, from Los Angeles, Cal., consulted me October 2, 1887. She was brought to my office directly from the train, her head enveloped in shawls. The right side of her face and head is very much swollen, with œdema of lids and conjunctiva. The right auricle is standing almost at right angles. On right mastoid is a large swelling of purple color, including the whole region of the mastoid and extending upwards over the auricle, also into the occipital region. The meatus is moist with fetid pus, its walls swollen, thus preventing inspection of *membrana tympani*. I made an incision 1½ *cm* long, emptying three to four tablespoonfuls of decomposed pus. Syringed with carbolized water, introduced a drainage-tube, and applied a bandage.

October 3d.—She had a good night, no pain, no fever, the discharge very much reduced. The œdema of lids has receded. Treated in same manner and allowed patient to get up.

October 4th.—Same condition and treatment. She gave the following history: When a child she often complained of earache. Two years ago, after a horseback ride, she had severe earache on the right side which lasted all night, and was followed by a discharge. In a few days the discharge ceased almost entirely, but was noticed again whenever she had a cold and earache. Twice since the first attack the earache was followed by an abscess behind the ear, which was lanced each time and healed rapidly. The present abscess was much larger than the previous ones, and she suffered much more. She did not have it lanced because the attending physician proposed opening the bone.

October 5th; Operation, Dr. de Vecchi assisting. She complains of distress in the cardiac region. As soon as the narcosis was begun she vomited immense quantities of undigested food remaining from the supper of the evening before. Considerable time was lost in disinfecting and shaving. The incision through the infiltrated tissues, which were 2 to 3 *cm* thick, was followed by

profuse parenchymatous hemorrhage. The periosteum was detached from the bone. The surface of external plate was rough but not discolored, and no fistula could be detected. The *spina supra meatum*, as well as the openings for emissary vessels, were well marked. I began to chisel the external plate, which was about 3 *mm* thick ; pus oozed out freely. The external opening was properly enlarged ; then the scoop was resorted to, and the mastoid which was transformed into an abscess filled with pus, cheesy substance, and granulations, was thoroughly scooped out to a depth of almost 3 *cm* in the bone itself. As soon as patient recovered from the narcosis, a forced injection was tried, but no communication existed. As usual, the cavity was filled with iodoform gauze and bandaged antiseptically.

October 6th.—Patient slept well, but still complained of distress in the stomach. I regulated the diet. The bandage is dry but stained with blood. The wound is in good condition, and the swelling of the soft tissues very much reduced. The opening in the bone presents a good appearance. The swelling of the meatus is also very much less. There is no purulent discharge either from the mastoid or the meatus. No fever. After carefully syringing with carbolized water, whereby no communication was obtained, dressed with iodoform gauze as usual. Patient will remain in bed.

October 7th.—Same condition as yesterday, but with less swelling of soft parts. Same treatment.

October 8th.—She called at my office for treatment. No change.

October 9th.—Very slight suppuration from the mastoid, but none from the meatus, external plate is pink in color. In syringing no communication obtained.

October 14th.—She has been treated daily. The soft tissues are granulating very rapidly, and are now 1 *cm* thick. The lumen of external meatus is now normal, and the *membrana tympani* appears thickened and injected ; no perforation is visible. The opening in the mastoid is lined with granulations, and is now almost 2 *cm* deep. The discharge being scanty, the bandage is dispensed with, and the wound covered with sublimated gauze held by a spring.

October 17th.—She has been seen daily, and her general health is the very best. Depth of wound, including soft integuments, $2\frac{3}{4}$ *cm*. Meatus normal ; *memb. tympani* is getting pale ; $h = \frac{0.2}{5}$. Same treatment.

October 26th.—Conical lead nail $2\frac{3}{4}$ *cm* long inserted without difficulty.

October 27th.—Nail-bed smooth, scarcely any discharge.

October 29th, 10 A.M.—She had earache during the night. The soft integuments covering the mastoid and the posterior surface of the auricle are œdematous. The upper wall of the meatus is also very much swollen. Finding no special reason for this condition, I presumed that the nail was too long, and that perhaps the strong spring produced too much pressure. Therefore I changed the nail for a shorter one and applied a weaker spring. At 4 P.M. she called again very much alarmed about pain in the mastoid; this was produced by displacement of the nail and spring. She was cautioned to be less lively and to be careful not to displace the spring.

October 30th.—She had no more pain, the œdema having almost entirely subsided.

November 15th.—The same treatment daily; no further complications. The nail has been gradually reduced in length and size, the fistula cleansed daily with a 5 % solution of carbolic acid. To-day the nail-bed still measured almost 1½ *cm*. In order to accelerate the healing it was carefully scraped with a sharp scoop, and the nail reinserted immediately.

November 20th.—The nail-bed is 1½ *cm* deep, but very much contracted; no discharge. The thin nail, still 1 *cm* long, was removed.

November 26th.—$h = 0,\frac{1}{4}$. A fine probe can still be introduced 1½ *cm*. Meatus normal. During the last few days, there being no discharge whatever, the spring was removed and the fistulous opening covered with plaster.

December 1st.—No further trace of the fistula. On mastoid a depressed linear cicatrix is present.

November, 1888.—Patient has been seen several times since, and has had no more trouble.

According to the history of the case one would suppose that the otorrhœa which began two years previously never healed, but that it became chronic with acute relapses upon three occasions. Also that during the time the mastoid became implicated, spontaneous perforation of the external plate followed, with formation of subperiosteal abscesses. After the abscess was opened, the fistula in the bone would become clogged by granulations, thus apparently remaining well until the next acute relapse of the otorrhœa. Such cases are very frequent, especially in children; and I thought

I was dealing with such a case. I was therefore very much astonished when I found the external plate without the least trace of an existing or a previous fistula. No doubt in this case, as well as in some of those already published in these ARCHIVES, the pus followed the posterior wall of the meatus, separating the skin from the periosteum and forming an abscess on the mastoid, the nearest large surface where the periosteum could be detached. Naturally, it remains undecided, whether or not a spontaneous perforation of the anterior surface of the mastoid, which is formed by the posterior wall of the meatus, took place, the pus then burrowing under the cutis and accumulating on the surface of the mastoid. Probably not, since after thoroughly scooping out all the decayed portion of the mastoid, no such communication was detected. In the after-treatment of this case the œdema produced by displacement or too strong pressure of the spring upon the nail is worthy of attention; whenever the nail is either too long or becomes displaced, this is followed by a redness and swelling of the soft integuments over the mastoid, often even with œdema of auricle and meatus. I must confess that before I was aware of this, I thought I had a case of incipient erysipelas before me. Therefore, in children, it is best to leave the nail out a couple of days and to replace it after all inflammatory symptoms have subsided. In adults the use of a smaller nail without much pressure from the headspring is all that is necessary to remove the swelling. If a larger nail is needed to keep up communication with the middle ear, several thorough and deep cauterizations with pure nitrate of silver should precede its insertion.

CASE 32.—**Acute Purulent Inflammation of the Right Middle Ear, with Thickened Membrana Tympani; Insufficient and Intermittent Perforation, Producing Retention of Pus; Mastoiditis with Eburneated Appendix; Operation; Doubtful Communication; Cure in Three Months.**

B——, male, aged sixty-four, sent from Oakland Sept. 30, 1887. He is a very large, powerful man; he was sitting in a chair when

I arrived, his head wrapped up in woollen cloths, his face wearing an expression of pain and weariness. He stated that about four weeks previous he had an earache on right side, probably from a cold he had at the same time. The physician whom he consulted ordered warm applications and drops for the ear. A second physician was consulted, who ordered syringing with large quantities of warm water and gave injections of morphia in the evening. There has never been much discharge from the ear, and lately none at all. The pain has continued steadily, at times with sharp shooting spells, and is much more intense during the night.

Status Præsens : Auricle and external meatus normal, no suppuration. ***Memb. tympani*** covered with dry epidermis. Mastoid region normal, somewhat painful to touch.

I applied a Priessnitz' compress and advised him to call at my office the next day for careful examination.

October 1st.—Came to the office as directed, stating that he had had a very bad night, suffering intense pain. I syringed the ear, removing a large quantity of macerated epidermis which had filled the innermost portion of the canal, covering the *memb. tympani.* After drying I found the *memb. tympani* dark red and bulging. I made a large paracentesis in the posterior half of the membrane ; pus oozed out at once. This was followed by inflation with Politzer, syringing, and application of Priessnitz.

October 2d.—He was not relieved by the puncture, having as much pain last night as the one previous. The pain began in the evening and continued all night ; he describes it as a deep-seated pain over the whole temporal region, and especially painful at the *tuber frontale.* The meatus is filled with thick pus, its walls are not swollen, and the mastoid region is normal, with no sensitiveness upon pressure. After inflation with Politzer, syringed with carbolized water and applied bandage. In case he had severe pain, he was advised to remove the bandage and have the ear filled repeatedly with warm water, and to apply an ice-bag to the side of the head.

October 3d.—He again had great pain during the night, and was only relieved as long as ice was kept on. Otherwise the condition of the ear remained the same. Same treatment.

October 5th.—He has the same trouble every night. No change has been noticed in the condition of the ear. Patient is worn out ; has lost flesh ; his complexion is pale yellow, and he desires to

be operated upon. He was sent to the German Hospital with proper directions for disinfection of the head and shaving of the temporal region.

October 6th; Operation.—Section through normal external integuments; periosteum attached, *spina supra meatum* not well defined and canals for emissary veins hardly perceptible. The prolongation of the *linea temporalis* was well marked; below this and close to the meatus was a noticeable depression. This spot was selected for opening, which was done with chisel and mallet. The external plate was exceedingly hard and compact, and 4 *mm* thick. At this depth small air cells were exposed; but the bone was still exceedingly hard until a depth of 1½ *cm* was reached. The bone substance, though still with but few air cells, became somewhat softer; with the chisel and scoop I penetrated to a little more than 2½ *cm*. There was slight hemorrhage from the inner portion of the bone, but neither degenerated mucous membrane nor pus was detected. The probe showing the bone to be very compact, I tried a forced injection through the meatus. In doing so the opening in the bone was well sponged and carefully watched by my assistant; he observed a few drops of pus oozing through the inner portion of the mastoid. This indicated that I was working in the proper direction and that the antrum would soon be reached. I continued with the scoop until a depth of 3 *cm* was reached, and though no antrum was observed, desisted from further interference. The mastoid and external meatus were packed with iodoform gauze and head bandaged as usual. Narcosis excellent; was semi-conscious during the latter part of the operation; felt very well the rest of the day.

October 7th.—Had considerable pain the first part of the night, and only felt relieved after taking three and a quarter teaspoonfuls of McMunn's elixir of opium. This morning he looks well, a great improvement in his appearance being already noticeable. No fever. The gauze filling the meatus hardly impregnated with pus; that filling the mastoid was removed. A forced injection was tried again; the fluid passed freely into the throat and nose, but no communication with the mastoid was detected. Dressed and bandaged in same manner. He felt very faint during the treatment. Ordered fluid food, ice-bag to the head, and one gramme of antipyrin three times a day.

October 8th.—About 11 o'clock at night pain began; the ice then feeling unpleasant, was discontinued. The pain ceased, and

he slept well after taking two half-teaspoonful doses of McMunn's elixir. No fever. The wound looks very well, and the surface of the bone appears slightly pink. There was more pus upon the gauze, filling the meatus and the mastoid to-day than on previous days. No communication in syringing. Same dressing. Solid food; he will get up and exercise in the hall.

October 9th.—He felt very well all day and until midnight, when pain began; this was relieved by half a teaspoonful of McMunn's. Amount of discharge about same as yesterday. I again tried to obtain communication, but did not succeed. To-day he leaves the hospital.

October 10th.—Twenty drops of opium at bedtime, followed by sound sleep all night. The muco-purulent discharge in the meatus has increased, but that in the mastoid has decreased. Again no communication obtained. *Memb. tymp.* appears red and thickened, perforation almost closed; after using a twenty-per-cent. solution of cocaine it was enlarged downwards. Inflation with Politzer and dressing as usual. Antipyrin was discontinued.

October 11th.—No special change. Still some pain during the night. Same treatment. Had fifteen drops of opium.

October 12th.—He had considerable pain nearly all night. No opiates were given. To-day same amount of secretion. By forced injection very feeble communication was obtained. Same treatment.

October 13th.—Same condition as yesterday, except that by forced injections through the meatus somewhat better communication was obtained. He requested to be allowed to take the antipyrin again, as, though not relieving the pain, it lessened it.

October 14th.—He slept well until eleven at night, when, having pain, he took some elixir of opium and then rested well until morning. The discharge from meatus as well as from mastoid is very profuse. No communication was obtained to-day. The perforation in *memb. tymp.* being very small, was again enlarged after the use of cocaine. The soft parts are covered with fine granulations, but none have formed on the bone. The general health of the patient has improved very much; he feels better now than at any time since the beginning of the ear trouble, his head being perfectly clear. This he attributes to the antipyrin, the use of which he will not discontinue.

October 15th.—He had great pain during the night, three doses of one-half teaspoonful each of the elixir failing to alleviate the

pain. This morning he feels easier, but does not look well. The discharge in the meatus has increased very much. The fistula in the bone was probed carefully, as usual, to try to find communication with the antrum. With a small, sharp scoop I attempted to scoop out the inner portions of the cavity, trying to obtain a better communication by the removal of small fragments of bone; this had to be done very carefully, as the opening was already 3 *cm* deep, and consequently I tried to work forwards more in the direction of the middle ear. No cavity was found, and no communication obtained in syringing. At 7 P.M. I went to Oakland to visit patient; he had had a very good day and anticipated a good night.

October 16th.—Had some pain during the night; this was relieved by the opiate.

October 18th.—On the 17th he had but little pain during the day, but at night it was continuous. Three half-teaspoonful doses of the elixir failed to relieve him.

October 19th.—He had only a little pain, and that at intervals; nevertheless, he slept well without an opiate. To-day there is less discharge from the meatus, but considerably more from the mastoid. No communication exists; forced injections are now avoided. Usual treatment.

October 20th.—Again a great deal of pain at night, not relieved by three half-teaspoonful doses of the elixir. Otherwise no change.

October 21st.—He had more or less pain yesterday afternoon, during the night, and this morning, but he slept without medicine. I found out that he attended to his business a few hours in the afternoon, and while there did not complain. He looks perfectly well. The cavity in the mastoid is almost entirely lined with sound granulations, but the discharge is still very profuse. A soft-rubber drainage-tube was applied.

October 22d.—I forbade the use of the opiate, and also, if possible, the antipyrin; in case of pain, I advised him to try the application of ice again.

October 23d.—He went to bed at 9 P.M. and slept very well until 1 A.M., when he was awakened by pain; he applied ice, but this failing to relieve, and suffering intensely, he had to take one half teaspoonful of the elixir; after this he slept until 9 A.M. No special change noticed.

October 24th.—Again an exceedingly bad night, the pain being at times worse than he had experienced before. He describes it

as a deep-seated, thumping pain, located in the occipital region, temple, and vertex. The discharge from mastoid and meatus still very profuse. In carefully sounding the mastoid no denuded bone was detected; the cavity is now only 1½ *cm* deep. I attempted to scoop out some of the granulations, but patient fainted and I desisted. I informed him that unless a very favorable change should soon take place I would be compelled to operate a second time.

October 25th.—During the night he rested better than at any time since the operation, and this without opiate. I would have doubted this if his general appearance had not been so favorable. The discharge about the same or perhaps a little less.

October 26th.—From the time he left my office until he went to bed he had some pain at intervals; however, he slept well without opiate. The fungous granulations externally were removed with the scissors; those in the fistula were cauterized with nitrate of silver.

October 27th.—Patient had slight pain during the day, but none at night, and slept well without opiate. There is undoubtedly less discharge from the meatus. Usual treatment.

October 28th.—He had some pain in temporal region only during the day; this increased at bedtime and compelled him to take one half-teaspoonful of the opiate, after which he slept soundly all night. The discharge from meatus and mastoid has decreased very much.

October 29th.—Again some pain during the day and at bedtime; this was relieved by two doses of half-teaspoonful of the elixir. The perforation in the *memb. tympani* being very small, it was again enlarged under cocaine. In doing this, thick pus escaped from the middle ear, proving that there was retention. As the soft-rubber drainage-tube in the mastoid would not stay in place, the fistula was cauterized thoroughly with nitrate of silver preparatory to the insertion of a nail.

October 30th.—The pain is now very slight; patient does not mention it unless asked. He has gained considerable flesh, his face looks bright and his complexion clear. The discharge from the middle ear is very profuse to-day; by inflation and inspection the perforation proved to be very free. After usual treatment, inserted a conical lead nail 2 *cm* long, held by a flannel roller bandage.

October 31st.—He had no pain, and slept well. Same amount of discharge. The nail was lost, having fallen out; a new one was applied, and held in place by a headspring.

November 1st.—The pain was again intense during the night, and he was relieved only after taking three spoonful doses of elixir. No special change noticed.

November 3d.—Yesterday and to-day he had no pain, and no opiate was required. Same treatment.

November 4th.—Two doses of the opiate had to be taken to relieve the pain. The discharge is decreasing daily.

November 11th.—Since the 4th, he has had scarcely any pain, and has not taken any opiate. The discharge from the mastoid has been decreasing perceptibly, and that from the middle ear is to-day muco-purulent. With the catheter, no râles heard. At the opening of the fistula, the granulations form so rapidly that they require frequent cauterization. The fistula is now 1 *cm* deep; it contracted so much after leaving the nail out for a few minutes that the nail was removed entirely.

November 14th.—Same treatment daily, with but little change. The discharge from middle ear still saturates the cotton filling the meatus. The fistula in mastoid is still 1 *cm* deep; it has been cauterized on different occasions, to keep the external opening free from fungous granulations, and is swabbed out daily with a 5 % solution of carbolic acid.

November 15th.—An application to the middle ear of a 4 % solution of nitrate of silver (after Schwartze) was tried to-day; otherwise usual treatment.

November 16th.—The consequence of yesterday's treatment is that the discharge from the middle ear has increased very much, and that patient suffered some pain during the night. After inflation and cleansing, I prescribed a saturated solution of boracic acid; this was to be syringed into the ear three or four times a day, then the ear was to be filled with the warm solution, and the latter was to be forced into the middle ear by pressure upon the tragus. An application was first tried in the office; the patient succeeded very well in forcing the fluid to run out of the nose. The fistula was contracted, so that only a fine probe can be introduced.

November 17th.—The discharge is very much reduced; he had no pain, and was advised to continue the same treatment.

November 20th.—He has used the boracic solution four times a day; has had sharp shooting pains at intervals. The fistula is almost closed; no secretion.

November 22d.—The discharge from the middle ear has in-

creased again, notwithstanding the applications (four times a day). Will continue the same treatment.

November 26th.—To-day, for the first time, no discharge whatever. The perforation in *memb. tymp.* small; air penetrates easily; no râles. With a fine probe I can still penetrate to the depth of 1 *cm* into the fistula.

In December, from 1st to 22d, he has been seen in the office every day; the boracic instillations were continued, though there was no more discharge. The fistula remains open, and is almost a capillary canal. Usually the sublimate gauze covering it is dry, but shows slight stains of pus in forty-eight hours, sometimes not until after a still longer period. The latter part of December the patient was seen four times; on the 25th the fistula had closed entirely. The *memb. tymp.* is pale, thickened, and has a perforation about the size of a pinhead in its posterior and lower segment. He was dismissed with directions to wear cotton in his ear for a few weeks.

During the month of January he called several times, partly from fear of getting worse again and partly to satisfy himself that the ear was in good condition. The perforation in the *memb. tymp.* closed entirely; $h = \frac{0.5}{5}$. On the mastoid is a linear scar, with no noticeable depression.

CASE 33.—**Acute Purulent Inflammation of the Right Middle Ear; Empyema Mastoidei; Operation; No Communication; Cure in Eight Weeks.**—D., male, in the thirties, consulted me Nov. 2, 1887, with his head wrapped up in shawls, suffering intensely, and gave the following history.

Six weeks previously, he was attacked with severe earache on right side. Poultices were applied, the ear soon began to discharge, but instead of decreasing the pain became more intense daily. Ten days afterwards he consulted a specialist, was attended by the latter twice, and then went to a second one who treated him for two weeks. A few days ago some swelling was noticed behind the ear; during the last forty-eight hours it has increased to its present size.

Status Præsens: Patient is a tall, muscular man; has always been in good health; he is very much reduced, and his expression shows that he must have suffered intensely. His right auricle stands out almost at right angles; behind is a large diffuse swelling, involving the temporal and a portion of

the occipital regions, and extending downward to the neck. He inclines his head towards the left; he screams upon the least touch to the swelling. This swelling shows signs of fluctuation at the base of the mastoid; elsewhere it feels like a hard infiltration. The meatus is filled with purulent discharge, but its walls are normal. When pressure is used upon the softer part of the swelling, pus oozes out of the meatus in larger quantity. I sent him to the German Hospital at once, with directions for shaving and disinfecting.

November 3d, 8 A.M.; *Operation*:—Ether narcosis. The dense infiltration of the tissues preventing sufficient retraction for operation, the incision was made larger than usual. The parenchymatous hemorrhage was very profuse, and required compression with sponges for several minutes. The external integuments were very dense, yellow, as if infiltrated with pus, having a thickness of one *cm* at the temporal region and increasing towards the neck. The periosteum was detached from the bone; the latter was discolored, especially near the meatus. *Spina supra meatum* and emissary canals not visible; the *linea temporalis* was flat, broad, and running downwards in a curve; no bony fistula was found; no pus on the surface of the bone. On account of the abnormal shape of the bone, and the absence of the principal guiding points, I began chiselling close to and at the level of the superior wall of the external meatus, where the bone was most discolored; here the bone was soft, and the chisel had hardly penetrated 1 or 2 *mm* when pus began to ooze out. The bone being very soft the chisel was put aside and the external opening enlarged with conical scoops; the undermined portions were snipped off with the bone forceps and the edges smoothed with a broad gouge. Thus the mastoid was transformed into a large abscess, which was carefully scooped out; this was followed by considerable hemorrhage. Besides the pus, the bone substance was mushy, and even contained granulations. On account of profuse hemorrhage, irrigation was kept up during the whole operation. By forced injection into the meatus, no communication was obtained. The external orifice of the cavity was packed round and measured 2 *cm* in diameter. The cavity was well with iodoform gauze, and the bandage applied tighter than usual so as to produce pressure.

November 4th.—Patient slept well and was entirely free from pain. The bandage is impregnated with pus, but is dry. The

swelling is very much reduced, and is no longer sensitive to touch. No fever. The gauze filling the mastoid was not disturbed ; that in the meatus shows no signs of suppuration. He was allowed to get out of bed.

November 5th.—He feels perfectly well, and has no pain. The gauze in the meatus shows traces of pus ; that filling the mastoid was also removed and found impregnated with pus and blood. The wound was irrigated thoroughly ; no communication. Dressed in same manner.

November 6th.—Patient desires to go home. Swelling and inflammation have almost entirely subsided.

November 7th.—He called at the office ; general health improved.

November 11th.—Patient has been treated daily with injections of carbolic acid, inflations, and packing of the mastoid with iodoform gauze. There has always been some slight discharge in the meatus ; with the increase of granulations in the mastoid, suppuration is more profuse.

November 14th.—The large cavity is lined with apparently healthy granulations, and is at present one half of its original size. Some days the cotton pellet in the meatus bears signs of suppuration ; at times again it is perfectly dry. The *membrana tympani* is injected.

November 16th.—The cavity is filling rapidly with granulations. I inserted a soft rubber drainage-tube (a piece of a French soft, red rubber catheter), left off the bandage and held dressing on with a spring. Meatus dry ; some râles heard by catheterization.

November 19th.—The rubber drainage-tube was replaced by a conical lead nail 1 ½ *cm* long. Fistula swabbed out with a 5 % solution of carbolic acid. The meatus remains perfectly dry.

November 25th.—On the 20th and 22d, the nail was shortened somewhat ; the granulations being very pale, were cauterized.

November 26th.—There is some purulent discharge in the meatus and very much from the mastoid, probably the result of yesterday's cauterization.

November 28th.—No more discharge from the middle ear, and very little from the mastoid. The fistula looking very well, the nail was again shortened.

December 23d.—He has been treated daily ; the nail which was still 1½ *cm* long has been lost ; the fistula was found almost entirely closed.

December 25th.—The fistula is now entirely closed, was covered

with a piece of court-plaster, and spring dispensed with. There is no discharge from the meatus, and but a few râles upon catheterization. *Memb. tymp.* has still a small perforation and appears moist.

December 31st.—Patient was treated on 27th and 29th. Mastoid completely cured; no pain upon pressure; some depression of cicatrix; perforation cured; *memb. tympani* slightly injected and thickened. Patient was dismissed and advised to wear cotton in the ear for several weeks.

CASE 34.—**Chronic Purulent Inflammation of the Left Middle Ear; Subperiosteal Abscess and Granulations; Sieve-like Perforation of the External Plate; Caries Mastoidei; Operation; Still under Treatment, One Year after the Operation.**

H. W——, male, aged eleven, was brought to me by his mother on November 25, 1887. The child is poorly nourished and kept very dirty. Since babyhood the left ear discharged, the discharge being very profuse at times and always having a bad odor. The mother syringed the ear now and then, and once consulted a druggist who prescribed ear-drops; but she has never consulted a physician. A few days ago the child began to complain of pain in the left ear and at the same time a swelling was noticed behind the ear; the ear was covered with moist rags and bandaged with woollen cloths. The swelling increased daily, until finally she consulted Dr. H. Wagner, who referred her to me.

Status Præsens: The left auricle œdematous; ext. meatus almost closed by swelling of its walls, fetid purulent discharge oozing from it. Behind the ear, a purple swelling covering the whole region of the mastoid.

The child was sent to the German Hospital at once; he had a bath, a shampoo, his head was disinfected and shaved over left temporal and a part of occipital region.

November 26th; Operation 8 A.M.—On account of the great swelling, the incision was made larger than usual and nearer to the auricle. Beneath the infiltrated skin was a thick layer of purple, fungous granulations, and under this a large quantity of pus. These soft tissues were detached from the bone, being undermined 5 to 6 *cm* in every direction. The granulations were scooped off and the soft tissues held apart, thus exposing the external surface of the bone. This was marked at the base of mastoid by numerous

pinhole openings. Slight pressure with the director was sufficient to break through the external plate, pus escaping at once. This opening was enlarged with sharp scoops as far as undermined, leaving an external orifice 2 to 2½ *cm* in size. The mastoid was transformed into a cavity filled with decomposed cheesy substance. It was carefully scooped out until the walls felt hard; the hemorrhage was very slight. In syringing, very free communication was obtained. The mastoid was packed with iodoform gauze and bandaged.

November 27th.—No fever. Bandage saturated with blood, but dry. No discharge in meatus. The gauze in the bone was not disturbed; in part it was very much adherent to the external wound. Syringed with a 2½ % solution of carbolic acid.

November 28th.—The mother wishes to remove the boy to her home; there being no fever, permission was given. No discharge in the meatus. The gauze in the mastoid was all removed, though still very much adherent; this produced slight hemorrhage. The boy fainted during the treatment. In syringing, no communication was obtained.

November 29th.—Same condition as yesterday except that in syringing communication was again obtained.

December 12th.—The boy has been treated daily without incident. The bone is granulating nicely, and there has always been free communication. Twice the granulations were cauterized; today a conical lead nail 2½ *cm* long was applied, only 2 *cm* of which were really in the bone as a sublimate gauze cushion was placed under the external plate to prevent strong pressure. A spring held the dressing in position.

December 20th.—The nail soon formed a smooth bed for itself; no trouble was experienced until last night, when the boy complained all night of sore-throat and severe earache on the right side. I found acute follicular tonsillitis and acute inflammation of the right middle ear with serous, sanguinolent discharge. I applied a Priessnitz compress and prescribed a gargle.

December 21st.—He again had severe earache during the night: the large moist pad covering the auricle was found saturated with serous discharge. Same treatment. On left side nothing abnormal.

December 22d.—The boy was feverish and weak. I advised the mother to keep him at home until he felt better, and to syringe the ears with carbolized water without removing the nail on left side.

December 25th.—The patient was brought to my office, having

more pain in the right ear, but with very profuse serous, sanguinolent discharge. Inflating by Politzer, a loud whistling sound is heard. The cotton pellet in the left ear was saturated with dark, fetid pus, and on syringing through mastoid good communication was obtained.

January 30, 1888.—Treatment has been continued daily in same manner. The communication is always very free, even with the fountain syringe (irrigator) with little force. The cotton pellet in the meatus is always found impregnated with the same dark, fetid discharge, necessitating irrigation with large quantities of carbolized water. On the 27th, 28th, and 29th of last month, the nail-bed was cauterized thoroughly on account of the communication not being perfectly free. In syringing, great caution is necessary as the boy becomes dizzy even when no pressure is used; on this account the irrigation was interrupted several times. The discharge from the right ear has become purulent and is dark and fetid.

February 5th.—He has been attended to daily; the communication is kept very free by occasional cauterizations. The discharge from both ears has decreased considerably, but still remains dark and very fetid.

February 15th.—Every thing remains in about the same condition in spite of careful daily treatment either by my assistant, Dr. E. S. Clark, or by myself. The conical nail is 26 *mm* long; the communication remains very free. To-day I discovered by probing, that beyond the inner end of the fistula a pocket extending backwards and upwards exists. This pocket was partly filled with granulations which bled freely when touched, and was certainly causing decomposition of pus by stagnation. The *membrana tympani* is totally destroyed, and the surface of the *cavum tympani* is lined with a serous-like membrane. The nail-bed runs, of course, towards the middle ear; and when the nail is in and kept in position by the spring, its inner end can by inspection be noticed in the middle ear. The diverticulum, or fistula leading to the pocket, opens at about the middle and posterior surface of the nail-bed. When the nail is in position it prevents the escape of secretion, which then stagnates in the pocket. With nitrate of silver melted upon the end of a silver probe, this pocket was thoroughly cauterized, and a smaller nail was applied, the end of which did not reach as far as the fistula leading to the pocket.

March 4th.—The pocket has been cauterized every second or third day, and is now very shallow.

March 21st.—At present there are scarcely any traces of a pocket; the former longer nail has been used for several days. The discharge is scanty, but dark, and has a very repulsive odor. The right ear has also been treated daily; at times it has been free from discharge for several days; the discharge then recurs; there is no pain.

November 1st.—In order to avoid repeating many of the details which occur in every case, I will give a general report of what has occurred since. The child has been treated daily in usual manner. Whenever the communication was at all obstructed, cauterizations with nitrate of silver were used. In general, the discharge has been slight, but almost black and very fetid. Twice it ceased entirely; but still the cotton pellet, after remaining in the meatus for twenty-four hours, had the same odor. Then, for experiment and being anxious to get rid of the case, the lead nail was shortened so as to allow the inner end of its bed to close, so that gradually it could be removed entirely. Each time this was tried for a few days, the discharge became very copious, and I was compelled to cauterize the nail-bed again, to re-establish communication, and to reinsert a longer nail. In syringing, large quantitities of the fluid have always been used. Carbolic acid in 2½ % as well as in 3 % solution had no effect on the fetid odor of the discharge.

In October I received the first sample of creolin, and tried this drug at first in a 2 % solution. After a very few trials, the fetid odor disappeared almost entirely. I will not say entirely, for probably some was hidden by the strong tarry odor of the drug. But used in this strength, the boy complained about strong burning pain in the ear lasting from one half to one hour after treatment; and besides, the external opening of the fistula and its surroundings appeared inflamed. A 1½ % solution had almost the same effect; if used weaker than this, the fetid odor soon returned. Upon the introduction of sublimate as an antiseptic, I tried it in some cases of chronic otorrhœa in solutions of 1:5000 or even stronger; but I abandoned its use, finding that it changed the secretion, or certain parts of the same, into a white precipitate that would remain adherent to the parts in the middle ear. In cases with almost complete destruction of the *memb. tympani* and but little discharge, these precipitates could be observed on the second and third day after the injection. I then returned to carbolic solution, until

encouraged by Kretschmann's article (*Archiv für Ohrenheilkunde*, 26 Band, 2 Heft, Seite 103). I then decided to give the sublimate a new trial in combination with either tartaric or muriatic acid. Our case was treated from the latter part of October, with sublimate tartaric solution 1:2500; this has produced no evil effects; the discharge has decreased considerably, and its fetid odor has disappeared. Three months ago, I yielded to the mother's request to continue the treatment a little longer, hoping to avoid a second operation.

November 20th.—Very slight discharge, almost no odor. The nail he has been wearing is only 1½ *cm* long. The entire length of the fistula is 28 to 30 *mm*. As far as the nail reaches, the canal is small and also conical; but beyond this point it becomes wider and irregular. Thus an opportunity is given for stagnation of pus beyond the inner end of the nail. To remedy this, the nail-bed, and especially its inner constricted portion, was cauterized thoroughly with nitrate of silver melted upon the end of a probe.

November 21st.—A nail, 28 *mm* long, was applied without difficulty. Sublimate muriatic solution is now used.

November 22d.—Very little discharge, and this is only slightly fetid. Beyond the inner end of nail-bed is a recess, and this, as well as the nail-bed itself, was cauterized thoroughly with nitrate of silver.

December 6th.—Since November 22d the fistula has been cauterized daily with nitrate of silver. To-day it was scooped out with a small sharp scoop; I discovered that the bone in the upper wall of the fistula was denuded and rough.

(*To be continued.*)

REPORT ON THE PROGRESS OF OTOLOGY DURING THE SECOND HALF OF THE YEAR 1888.

I.—NORMAL AND PATHOLOGICAL ANATOMY, HISTOLOGY, AND PHYSIOLOGY OF THE EAR AND NASO-PHARYNGEAL CAVITY.

By A. BARTH, Berlin.

Translated by Dr. Max Toeplitz, New York.

A.—ANATOMY.

a.—HEARING ORGAN.

1. Barth, A. On the representation of the membranous labyrinth in toto, with demonstration of specimens. Lecture delivered before the Physiological Society in Berlin, December 21, 1888.

2. Habermann, J. Contribution to the origin of cholesteatoma of the middle ear. *Arch. f. Ohrenheilk.*, vol. xxvii., p. 42.

3. Netter. Bacteriological investigations on acute otitis media. *Ann. des mal. de l'oreille et du larynx*, 1888, No. 10.

4. Rohrer, Fritz. On the pathogeny of bacteria in purulent affections of the ear. *Deutsche Med. Wochenschr.*, 1888, No. 44.

5. Rohrer, Fritz. Contribution to the morphology of the bacteria of the ear and naso-pharynx. With 5 colored plates. Zurich, 1889.

1. The author easily made beautiful and transparent specimens by imbuing the petrous bone, embedded in celloidin before decalcification, with a fatty material, viz.: common oil for large specimens and copal resin for smaller ones. After removal of the osseous frame the water is extracted from the specimens with absolute alcohol, and they are preserved in oil of origanum.

2. The petrous bone examined is taken from a man, twenty-one years of age, who had died of meningitis caused by a purulent otitis media, which had pierced the bone. While the outer anterior wall of the mastoid antrum was covered with numerous granulations, a cholesteatomatous mass, of the size of a pea, was found upon the posterior wall. A strip of epidermis, 2 to 3 *mm* wide, extended thence to the posterior margin of the handle of the malleus which, under the microscope, proved to be epidermis. In the posterior upper quadrant of the drum-membrane was a perforation, where the above-mentioned strip of epidermis passed directly into the outer integument. The author is convinced that the strip of epidermis, and subsequently the cholesteatoma, developed by the growing of the epidermis upon a spot where the mucous membrane had been destroyed by the processes of inflammation and suppuration. In the extremely thickened mucous membrane of the middle ear numerous cysts, which are probably to be considered as enlarged glands, were found at various places. In addition an atrophy of the cochlear nerve was found, which is explained as atrophy by disuse.

3. Acute otitis media is not an affection confined to narrow limits and always produced by the same microörganisms, but there are several kinds of inflammation, each one of which depends upon a separate infectious agent. Each kind has its characteristics, due to the peculiarities of the microbe to which it owes its origin. In the secretions of the acute otitis media the following four different species have been found up to date: (1) The streptococcus pyogenes. (2) Fraenkel's pneumococcus. (3) Friedlaender's microbe; and (4) the staphylococcus pyogenes.

a. Otitis media due to streptococcus is the most frequent and most severe form. It is frequently complicated with other symptoms owing their origin to the same microbe, among which the following are prominent: Abscesses of the skin, suppuration of the mastoid cells, purulent meningitis, phlebitis of the transverse sinus, and pyæmia.

b. Four entirely reliable observations prove the occurrence of Fraenkel's pneumococcus in the purulent discharges of otitis media (Zaufal, NETTER). The small number of cases does not indicate its rare occurrence in acute otitis media; on the contrary, Netter is sure of its frequent occurrence, especially in pneumonia and typhoid fever, where it takes the same fibro-

genous part as the microbe of pneumonia. This otitis is less severe than that due to the streptococcus, its course is rapid, leading to early perforation. Recovery takes place in a regular manner, but may be complicated with purulent meningitis.

c. Zaufal found in a single case Friedländer's pneumococcus, but it was not ascertained whether it was in this case the cause of the otitis media. Zaufál believes that this micrococcus is chiefly found in the severe cases of sero-sanguineous otitis media, which are almost invariably associated with severe complications.

d. Netter has found four times the staphylococcus aureus in the suppurations of otitis media, but never alone ; it was associated three times with staphylococcus alb., once with pneumococcus, and it appears comparatively late in the aural discharge. Simmonds and Fraenkel found in the suppuration of persons who had died with otitis media, as the only kind the staphylococcus flavus, and finally Rohrer proved the existence of a staphylococcus albus, but it cannot be ascertained whether the latter caused specific clinical symptoms.

How do the microörganisms enter the middle ear? Several paths serve this purpose. The frequency of bilateral inflammations of the middle ear in conjunction with the inflammations of the adjoining cavities of the nose and throat point to the fact that the source of the microbes should be looked for in the oral cavity, whence they pass through the tubes.

This kind of the infection explains the occurrence of otitis media in typhoid fever, rubeola, diphtheria, recurrens, and others, these diseases being almost invariably associated with affections of the pharynx. Dryness of the oral cavity, together with difficulty in swallowing, furthers the enormous propagation of the microbes in this locality, and at a time when the energy of the entire constitution is lowered to such an extent as to offer no resistance to the transference of these microbes. Besides, the microbes may migrate through the lymph- and blood-vessels into the middle ear, which is rarely the case.

The frequency with which the infection starts from the pharynx necessitates, at any rate, the importance of the strictest possible asepsis in fevers. The illustrations appeared in the following number of the *Annales.* GEORGES GELLÉ.

4 and 5. The first paper is a brief review of the lecture delivered at the last meeting of naturalists ; the second is an extensive

monograph describing and illustrating the different forms of bacteria which the author has found in the secretions of numerous cases of otitis. The work is thorough, and can be recommended for study as well as for reference.

b.—NASO-PHARYNGEAL CAVITY.

1. SCHWABACH, Berlin. Contribution to the development of the pharyngeal tonsil. (From the Anatomical Institute of Berlin.) With one plate. *Arch. of Microscop. Anat.*, vol. xxxii., p. 187.

2. KILLIAN, G., Freiburg i. Br. On the bursa and tonsilla pharyngea. "Habilitation paper" (qualifying for lectureship).

3. KIESSELBACH. On the amount of mucus in the nasal polypi. *Monatsschr. f. Ohrenheilk.*, etc., 1888, No. 12.

4. GRUBER, WENZEL. Anatomical notes. On cases of partition of the maxillary sinus by a septum osseum perfectum into two entirely separate sinus maxillares secundarii, with separate openings leading into the meatus narium medius. *Virchow's Archiv*, vol. cxiii., p. 530.

1. Forty-five human embryos were examined; of 22 of these were made series of sagittal sections, and of 4 series of frontal sections. Almost all specimens were macroscopically examined.

2. The careful and exhaustive paper is illustrated with a great number of drawings. Sixty-five human embryos, 3 new-born, 2 children from the first year of age, and a great many animals were examined. In 28 among the 70 human subjects the bursa was entirely absent. Eight of these from the sixth and eighth month presented at the roof of the pharynx numerous folds of the mucous membrane, which represent the rudiment of the pharyngeal tonsil. Forty-two showed a more or less deep small pit; 14 cases, however, presented classical examples of a real bursa pharyngea in the human embryo (4 of these with pharyngeal tonsil).

3. The author attributes the difference of opinion between himself and Hopmann with regard to his claims to the presence of mucus in the nasal polypi, to the different procedure of procuring the material for examination. He also believes that the peculiar character of the nasal polypi is essentially dependent upon œdemata from congestion, but he has of late found mucus in all specimens examined.

4. The author observed the abnormality of the maxillary cavity mentioned in the heading, three times on one side, twice bilater-

ally; in one case the antrum was on one side divided by septa into three cavities, the two smaller of which communicated with each other in such a manner as to present two openings leading into the middle nasal meatus.

B.—PHYSIOLOGY AND PHYSICS.

a.—HEARING ORGAN.

1. BREUER, I., Vienna. New experiments made on the semicircular canals. *Pflüger's Arch. f. Physiol.*, vol. xliv., p. 135.

2. GRADENIGO, GIUSEPPE (Lecturer on otology at the Royal University of Padua). The electrical reaction of the acoustic nerve. Preliminary communication. *Centralbl. f. d. med. Wissensch.*, 1888, No. 39, 40, and 41.

3. LOEWENBERG, B. Physiological researches on nasal sounds. *Trans. 9th Intern. Med. Cong.*, 1887.

4. MALONEY, J. A. The sphenoid bone: some of its probable functions. *N. Y. Med. Jour.*, Aug. 11, 1888.

5. RICHEY, S. O. The primary physiological purpose of the membrana tympani. *Trans. Amer. Otol. Soc.*, 1888.

1. Baginski has, from his experiments, arrived at the conclusion that an irritation of the semicircular canals without simultaneous irritation of the brain is impossible, and that, therefore, one is not justified in drawing inferences from symptoms occurring after irritation of one semicircular canal as to the function of the semicircular canals. The author dissected the semicircular canals and applied the irritation to the entirely intact osseous ampullæ in slight ether narcosis. He made experiments with thermal, electrical, and mechanical irritation. BREUER arrives, from his experiments, which are entirely unobjectionable, at the following conclusions: From each ampulla, resp. each semicircular canal, movements of the head in the plane of the corresponding canal may be produced by mechanical, thermal, and electrical irritation. A direct irritation of the cerebellum thereby does not take place. The latter takes part in the phenomena probably as a reflex centre, one peripheral sensory organ of which is the vestibule. The movements are, in some of the experiments, produced by endolymphatic currents, the direction of which determines the direction of the movements of the head in the manner theoretically demanded. The phenomena of the galvanic vertigo appear under

conditions which exclude the supposition of an association with secondary currents in the brain. The galvanic vertigo is chiefly produced by irritation of the vestibular apparatus, like the galvanic phosphene by irritation of the retina.

2. GRADENIGO placed in his experiments the positive electrode either in front of the tragus or upon the external meatus filled with water, the negative upon the nape of the neck. He arrives at the following results: (1) Under entirely normal conditions one can but exceptionally produce a reaction of the acoustic nerve, even with the greatest intensity of current, which can still be borne on the head. *One ought therefore not to speak of a normal reaction of the acoustic.* (2) The diseases with regard to the electrical action are divided into two classes: into those with, and into those without, increased irritability of the acoustic. The author describes the electrical reactions in the various forms of ear disease, and attributes great importance to them.

3. LOEWENBERG has found the musical notes for each nasal vowel as determined by a corresponding vibration of the tuning-forks of Koenig and as compared with the known vowel sounds. He first took the French nasal vowels on, an, en, un, and then the non-French nasal vowels ong, ang, eng, ung, and found that the proper sound of the French nasal sounds of the first three series are very nearly the minor thirds inferior to the notes for the corresponding simple vowels, while those of the non-French ones approach by about half a tone the lower octave of these.

SWAN M. BURNETT.

4. MALONEY has found by experiment that the sphenoid transmits vibrations much more readily than any of the other cranial bones. These experiments were made both with gross vibrations and with the more delicate ones, using in the latter case the telephone as the receptive instrument. By this high conductibility on the part of the sphenoid he accounts (1) for the localization of sounds, "the indirect or bone-conduction being through the sphenoid (from one wing to the other, and thence to the internal ear on the opposite side), thus probably gives a maximum and minimum sensation by which the mental act of localization of sound is accomplished." (2) *Tinnitus aurium*, he thinks, may come often from transmission of the vibrations of the sphenoid derived from the blood currents passing through it. (3) *Autophonia* may in some instances be accounted for by the transmission of vibrations from the resonant cavity of the pharynx directly through the sphenoid

to the auditory nerves. (4) ***Colored audition***, he thinks, might be accounted for by the transmission of the vibrations of sound through the sphenoid to the optic nerve as it passes through the optic foramen and thence to the visual centre.

SWAN M. BURNETT.

5. RICHEY's conclusions are as follows: (1) The primary function of the membrane of the tympanum is one of protection: to prevent drying and stiffening of the membrana secundaria and the joints of the ossicles, etc. (2) The function of the *Mt* as a transmitting mechanism is secondary. (3) A permanent opening of the *Mt* may temporarily improve hearing, but not permanently; and (4) the effect of nature to heal perforations should be encouraged.

SWAN M. BURNETT.

b.—NASO-PHARYNGEAL CAVITY.

1. ZWAARDEMAKER, H. On the determination of the intensity of smell. *Berliner klin. Wochenschr.*, 1888, p. 950.

1. The author determines the intensity of smell by the following simple instrument: Of two tubes sliding into each other the inner surface of the outer tube is painted with a smelling material. According as one pushes the inner tube more or less deeply into the other a smaller or larger surface of the smelling substance will be exposed to the air striking it, and will give off a corresponding amount of odorous substances. If one breathes through the prolonged end of the inner tube one can readily compare at a scale attached to the outer tube the different intensity of smell, and determine this in each case as fraction formed by the decreased and the normal sensation.

II.—PATHOLOGY AND THERAPEUTICS.

BY A. HARTMANN, BERLIN.

Translated by Dr. MAX TOEPLITZ, New York.

GENERAL LITERATURE.

1. WAGENHÄUSER. Report on the work done at the university policlinic for ear patients at Tübingen from April 1, 1884, to April 1, 1888. *Arch. f. Ohrenheilk.*, vol. xxvii., p. 156.

2. BISHOP, S. S. Statistical report of 5,700 cases of ear disease, classified by age, sex, occupation, and disease. *Trans. 9th Intern. Med. Cong.*, 1887.

3. BLAU, L., Berlin. The affections of the hearing organ in measles. *Arch. f. Ohrenheilk.*, vol., xxvii., p. 139.

4. GELLÉ. On deafness in albuminuria. *Soc. Biol.*, March, 2, 1888.

5. WAGNIER. Otite moyenne aiguë observée sur un lépreux; examen des cavités du nez, du pharynx, et du larynx. *Annales de dermatologie*, etc., Série ii.

6. LICHTWITZ, L. On creoline, and its application to diseases of the nose, ears, and pharynx. *Bull. med.*, 1888, No. 78.

7. RICHEY, S. O. Is general atrophy of the conducting apparatus of the ear identical with progressive arthritis deformans? *Trans. 9th Intern. Med. Cong.*, 1887.

8. HOBBY, C. M. Cerebro-spinal fever as a cause of deafness. *Trans. 9th Intern. Med. Cong.*, 1887.

9. MURRELL, T. E. Peculiarities in the structure and diseases of the ear in the negro. *Trans. 9th Intern. Med. Cong.*, 1887.

1. At the university policlinic of Tübingen, 1,851 patients were treated during four years, 115 of which were operated on. The auricle was detached in one case for removal of a foreign body. Exostosis in the auditory meatus was observed in a patient, seventeen years of age. In one case acute otitis media, together with the severest cerebral symptoms (opisthotonus, rigidity of the neck, spasms of the extensor muscles, Cheyne-Stokes respiratory phenomenon), was observed, caused by the entrance into the ear of an ascaris lumbricoides, 10 *cm* long and 2 *mm* thick. After its removal from the meatus, in cleansing the ear, all symptoms disappeared. With regard to ear diseases following measles, WAGENHÄUSER found in almost all cases considerable secretion in the nose and naso-pharynx, and therefore believes that we have mostly to deal with processes propagated from the naso-pharynx.

2. Only the salient points of BISHOP'S paper can be given. Of the whole number 5.1 % were affected with acute catarrhal inflammation; 5.3 % with acute suppurative inflammation; 53 % with chronic non-suppurative disease. The external ear was affected in 8 %, the internal ear in 2 %, and 6 % were deaf-mutes. More than half of these had in-door occupations. The sexes were affected in equal proportion. Children under fifteen years constituted about 28 % of the whole number of cases.

SWAN M. BURNETT.

3. BLAU reports his observations on diseases of the hearing organ in measles. They comprise 65 cases among 2,560 ear patients.

According to the statistical reports, there are 3.1 % of the affections of the hearing organ in measles, and 5.2 % in scarlatina. Blau thinks, like Tobeitz, that in aural complications in morbilli, we have to deal with a primary exanthematous disease of the hearing organ. The cases observed by him belong to the following ear diseases: Otitis media catarrhalis acuta, 12 cases; otitis media suppurativa acuta, 16; otitis media suppurativa chronica, 31; remnants of chronic inflammatory processes in the middle ear, 12; otitis externa diphtheritica, 1; nervous deafness, 3. All acute cases were cured, with recovery of normal hearing power. In the chronic cases, extreme deafness frequently remains.

4. GELLÉ reports an observation of sudden deafness during albuminuria, which was associated with pneumogastric affections.

5. WAGNIER found one external meatus of a leper filled with fairly hard yellowish and firmly adherent crusts. After their removal the walls appeared lined with white lamellæ, upon an uneven surface. The drum-membrane had the same appearance, visibly reddened at one spot. Considerable deafness. On the other side the same condition, besides perforation of the memb. tymp. and purulent discharge. The crusts overlying both meatuses formed anew after their removal. Wagnier believes that there were leprous nodules in this ear. Besides, they were found upon the soft palate and in the larynx.

6. LICHTWITZ recommends creoline as the strongest disinfectant and deodorizing remedy for all diseases in which offensive smells originating in the cavities of the nose, mouth, or ear have to be removed. It diminishes the pathological secretions in cases of rhinitis atrophicans, fibrosa, and in otorrhœa. It is a powerful antiseptic and is easily applied, besides being hardly poisonous when compared with other drugs. Lichtwitz uses in the nose a diluted emulsion 1:5,000 to 1:2,000, whilst in pharyngitides and oral affections stronger solutions of ½ to 1:100 are necessary. In the ears, 1:1,000 are used for injections, and more concentrated for instillations. GELLÉ.

7. RICHEY traces out in his paper the similarity between progressive arthritis deformans and general atrophy of the conducting apparatus of the ear point by point, and is thoroughly convinced that many cases of "dry catarrh" of the middle ear are due to this authentic affection of the joints of the ossicula and their other bony connections. SWAN M. BURNETT.

8. HOBBY gives statistics from the State Board of Health of Iowa and from the Iowa Institution for the Deaf and Dumb. His conclusions are: That cerebro-spinal fever is equal in importance in the production of deafness with scarlet-fever, and that those cases which are often reported as due to "fever," "congenital," unknown," etc., are really due to this. SWAN M. BURNETT.

9. MURRELL has found that the auditory canal in the negro is very large and straight, enabling the memb. tymp. to be examined without a speculum. The memb. tymp. itself offers nothing peculiar. The mastoid process is smaller than in the white race. The pharyngeal openings of the Eustachian tubes are very broad, and the inferior meatus of the nose are larger. The auricle is less liable to cutaneous affections than in the white man. He has never seen any parasitic disease of the external auditory canal in that race, nor a furuncle. He finds otitis med-supp. acuta not infrequent an affection, but it is usually mild in its course, as is the chronic form, which is rare even in children of the pure type. In mulattoes it is more common. He has never seen a case of mastoiditis in the race. In 421 aural cases amongst this race there was not one of chronic aural catarrh. Their exemption from these troubles the author thinks largely due to the formation of the naso-pharynx. In fact ear diseases are very infrequent in this race as compared with the white race, and excludiag deaf-mutes, there are very few negroes who have not sufficient hearing power to understand ordinary conversation. All of this the reviewer can corroborate. See his paper in these ARCHIVES, vol. xvi., No. 4.

SWAN M. BURNETT.

INSTRUMENTS AND METHODS OF EXAMINATION.

10. SEXTON, S. A new head lantern for the employment of electric light in aural surgery. *Trans. Amer. Otol. Soc.*, 1888.

11. BISHOP, S. S. A new otoscope (pneumatic) for the diagnosis of middle-ear affections under passive motion. *Jour. Amer. Med. Ass'n*, Sept. 22, 1888.

12. YOUNG, H. B. The techniphone snap a substitute for the watch as a test for hearing. *Trans. 9th Intern. Med. Cong.*, 1887.

13. TANSLEY, J. O. An improved aural snare. *Trans. Amer. Otol. Soc.*, 1888.

10. SEXTON exhibited a modification of the Trouvé lantern for use in aural surgery. It is figured, as is also the portable storage battery for running it. SWAN M. BURNETT.

11. BISHOP'S new otoscope is a milled cylinder, with an ear funnel at one end, and an eye-piece containing a lens around which revolves an adjustable mirror at the other. In the funnel end is a pneumatic chamber with a flexible tube ending in a rubber bulb or lip-piece. The tip of the funnel is covered with a thin rubber tubing to cause it to fit more closely in the meatus. The manner of working it is similar of course to Sigle's well-known apparatus. He has found it of benefit in those cases where there were adhesions in the drum cavity, and has never seen any ill results follow its use. SWAN M. BURNETT.

12. The techniphone of YOUNG consists of a steel strip 3 *cm* long, 1 *cm* wide, and ½ *mm* in thickness, slightly dished (dented) at its centre. This is taken between the thumb and forefinger, and pressure on its edges makes a snapping sound after the manner of a well-known toy. SWAN M. BURNETT.

13. In TANSLEY'S snare the wire is fixed to the axle of a bobbin which is turned by the milled heads at each end. Either one or both ends of the wire may be fastened by the bobbin. The advantage claimed is that there is no sudden jump or jerk of the instrument when the polypus is cut through.

SWAN M. BURNETT.

EXTERNAL EAR.

14. SOUTHAM, T. A. On the occurrence of hæmatoma of the ear in football players. *Brit. Med. Jour.*, p. 1277, 1888.

15. LOEWENBERG, Paris. On the nature and the treatment of the furuncle, especially in the external ear. *Deutsch. med. Wochenschr.*, No. 28, 1888.

16. LOEWENBERG, B. On the treatment and bacteriology of aural furuncles. *Trans. 9th Internat. Med. Congr.*, 1887.

17. FELICI FRANC. Sifilide dell' orecchio. *Boll. delle mal. dell' orecchio*, etc. No. 3, 1887.

18. KOLLOCK, C. W. Foreign bodies in the external auditory canal. *N. Y. Med. Jour.*, August 18, 1888.

19. SEXTON, SAMUEL. Foreign bodies in the external auditory canal. *Tran. Amer. Otol. Soc.*, 1888.

20. BEZOLD, Munich. Foreign bodies in the ear. *Berliner klin. Wochensch.*, No. 26, 1888.

21. MARIAN, Aussig. On foreign bodies in the ear and in the nose. *Prager med. Wochenschr.*, No. 42, 1888.

22. RICHARDS, HUNTINGTON. A case of "false drum." *Trans. Amer. Otol. Soc.*, 1888.

14. SOUTHAM discusses the frequency of othæmatoma in foot-ball players. Its occurrence is facilitated by the fact, that the trauma acts on the ear in a state of congestion. The blood effusion is, as a rule, absorbed. In the reported case, a new swelling appeared at each new game; recovery took place with considerable deformity.

15. LOEWENBERG refers in the latest communication to his former well-known articles on the occurrence of micrococci in aural furuncles and on the infectiousness of furuncles. From the latter the transmission to other persons and to other regions of the body, and the tendency to relapses are explained. Loewenberg found to be most frequent, in the cultures made from the contents of the furuncle, the staphylococcus albus,—which was missing in one case only, and of the same frequency the staphylococcus aureus and citreus. In a single case all three forms of staphylococci were present. Loewenberg's treatment consists in aural baths with saturated solutions of boric acid in absolute alcohol. He succeeds in great many cases in cutting short the duration of the affection, whilst he is not so successful in others. Relapses are prevented by this treatment. The remedy may be used as a prophylactic.

16. This article does not contain any thing differing from the preceding one.

17. FELICI describes a syphilitic primary affection of the external meatus and the secondary and tertiary forms of syphilis of the ear. He points out that one has to think of a syphilitic affection of the inner ear in Ménière's vertigo with rapid decrease of bone-conduction for the tuning-fork.

18. KOLLOCK relates a case where two apple seeds had remained in the ear for forty years. Though that ear was very deaf the hardness of hearing seemed to be quite independent of the foreign bodies. SWAN M. BURNETT.

19. SEXTON gives statistics of 101 foreign bodies in the external meatus which he has recorded in his practice. Of these, a more or less detailed account is given of 39, which seemed to the author as having some special interest. Almost every department of animate and inanimate nature was represented. Cockroaches

were largest in number (13), cherry-stones 8 ; cotton-wool pellets 10, small stones 8, beans 6, bed-bugs 5, flies 5, maggots and peas 4 each. In their removal he used his own glass syringe which has already been described, his foreign-body forceps, and foreign-body curette, all of which are figured.

SWAN M. BURNETT.

20. BEZOLD is right to inveigh against the attempts at extracting foreign bodies in the ear without illumination with the forehead mirror and the necessary practice in handling the instruments used for this purpose. Crude attempts, though made by surgeons, frequently resulted in leptomeningitis, brain abscess, and death within one to four weeks, whilst the foreign body itself never or rarely presents such disastrous results. He adds to six such cases already published, a contribution on the difficult abstraction of carob seeds, which, conforming to the shape of the cavity of the recess in children, entirely fill this cavity, and thus offer to all manipulations acting a tergo insuperable obstacles.[1] Bezold's patient, a girl of six years of age, died also in the third week from a leptomeningitis and thrombosis of the transverse sinus, purulent disintegration. The author is inclined to believe that at least a part of the cases of reflex neuroses which have been described in literature as due to foreign bodies, should be attributed to beginning meningitis. If deafness arises, the indicatio vitalis requires chiselling of the mastoid process, with removal of the posterior wall of the external auditory meatus for the immediate extraction of the foreign body ; in inflammatory processes of mastoid, chiselling would also be indicated.

21. MARIAN found, among 2,626 ear patients, 37 cases of foreign bodies, which percentage, 1.4 per cent., is in accordance with the publication of other authors. The longest period during which a foreign body remained in the ear was thirty years. The author, like every writer on the subject, warns against the forcible removal of such bodies by instruments whilst they can remain in the ear harmlessly for a long time.

22. In RICHARDS' case the hearing in the affected ear was totally lost, and there was a vague recollection of an otitis media in childhood. At some distance in front of the normal position of the drum-head a membrane was stretched across the lumen of the auditory canal. It merged into the skin at the periphery and resembled the same in color and touch. It was smooth, with

[1] Compare Dr. Sargent's case in vol. xvii., p. 102, of these ARCHIVES.—K.

no suggestion of malleus handle or light spot. It was incised, causing no pain, though the edges of the incision were bloody. Beyond it was found the deep cavity, reaching to the promontory, the real membrana tympani being absent. The hearing power was not improved by the operation. SWAN M. BURNETT.

•

MIDDLE EAR.

23. Moos, Heidelberg. Contribution to the bacteriological diagnosis and prognosis of suppurations of the middle ear. *Deutsche med. Wochenschrift*, 1888, No. 44.

24. ROHRER, Zurich. On the pathogeny of bacteria and purulent processes of the ear. *Ibid.*

25. CHATELLIER. Acute otitis media with exudation. Bacteriological examination. Soc. Anatomique, Nov. 23, 1888.

26. RING, FRANK W. Four cases of acute inflammation of the middle ear from the use of Roosa's nasal inhaler. *Medical Record*, Aug. 11, 1888.

27. KIPP, C. J. Three cases of transient bilateral horizontal nystagmus occurring in connection with purulent inflammation of the middle ear. *Trans. Amer. Otol. Soc.*, 1888.

28. POMEROY, O. D. A case of chronic suppurative otitis media with abscess in the neck and destructive purulent iridochoroiditis, probably metastatic. *Trans. Amer. Otol. Soc.*, 1888.

29. STONE, GEORGE, Liverpool. Aural polypus. *Medico-Chirurgical Journal*, July, 1888.

30. RICHARDS, HUNTINGTON. A case of polypoid angioma of the ear, with three micro-photographs. *Trans. Amer. Otol. Soc.*, 1888.

31. SUAREZ DE MENDOZA. Sur un cas d'épilepsie guéri par l'ablation d'un polype de la caisse qui occupait tout le conduit auditif. *Revue mens. de laryngologie*, etc., 1888, No. 8.

32. THEOBALD, SAMUEL. The employment of boracic acid in solution in the treatment of otitis media suppurativa. *Trans. Amer. Otol. Soc.*, 1888.

33. BERMANN, ISIDOR. The uses of lactic acid in chronic suppurative otitis. *Jour. Amer. Med. Ass'n*, Aug. 11, 1888.

34. EMERSON, J. B. The flexible catheter as a drainage-tube *Trans. Amer. Otol. Soc.*, 1888.

35. TILLEY, ROBERT. Inherited syphilis as a factor in suppurative inflammation of the middle ear. *Trans. 9th Intern. Med. Cong.*, 1887.

36. BURNETT, C. H. Chronic purulent inflammation of the tympanic attic (recessus epitympanicus). Based on the observation of 10 cases additional to 10 cases already reported elsewhere. *Trans. Amer. Otol. Soc.*, 1888.

37. SEXTON, SAMUEL. Excision of the drum-head and ossicles for the cure of chronic purulent inflammation of the attic of the tympanum. *Trans. Amer. Otol. Soc.*, 1888.

38. HOFFMANN, E. Contribution to the pathology and therapeutics of pachymeningitis externa purulenta following inflammation of the middle ear. *Deutsche Zeitschr. f. Chirurgie*, vol xxviii.

39. ROSSI, EMILIO DE. Passaggio intracranico della marcia nella carie del temporale con ascessi per congestione al colle. *Atti della R. academia medica di Roma*, anno v., vol. iv., series 2.

40. BACON, GORHAM. A case of cerebral abscess following extensive necrosis of the temporal bone in which the skull was trephined by Dr. Robert F. Weir. Death from secondary hemorrhage. Autopsy. *Trans. Amer. Otol. Soc.*, 1888.

41. FULTON, JOHN F. Acute primary inflammation of the mastoid cells. *Trans. 9th Intern. Med. Cong.*, 1887.

42. FROTHINGHAM, G. E. The indications for the artificial perforation of the mastoid process and the best method of performing the operation. *Trans. 9th Intern. Med. Cong.*, 1887.

43. SCHMIEGELOW, E., Copenhagen. Resectio processus mastoidei. 30 operations. *Nord. med. Arch.*, 1888, vol. xx., No. 9.

44. The chisel as a bone-cutting instrument in opening the mastoid. The late Senator Conkling's case. *Internat. Jour. Surg. and Antiseptics*, April, 1888.

45. BERGER. On the procedure for the removal of projectiles of small calibre which have entered the tympanic cavity. *Soc. de Chirurgie*, Oct. 10, 1888.

46. LAUTERBACH, L. J. The value of nitro-glycerine in tinnitus aurium. *Trans. 9th Intern. Med. Cong.*, 1887.

47. TANSLEY, J. O. Nasal difficulties in ear diseases. *Trans. Amer. Otol. Soc.*, 1888.

48. The importance of the chain of ossicles for the transmission of sound. *Soc. de Biologie*, Oct. 13, 1888.

23. Moos confirms by three communications Zaufal's statements on the importance of bacteria in suppurative otitis media. In the first case of chronic suppuration of the middle ear in a diabetic with inflammation of the mastoid process and abscess formation, there were found in the discharged pus numerous streptococci and the diplococcus of Fraenkel-Weichselbaum. The same condition was found in a second analogous case. In a third case of polypi and cholesteteatoma with caries, phlebitis, and thrombosis of the lateral sinus, septic thrombosis in the bulbus venæ jugularis, meningitis purulenta of the base, and cerebellar abscess—large masses of streptococci were present in the cholesteatomatous masses. Moos believes that we have advanced considerably by Zaufal's examinations, both in the diagnosis and prognosis of the suppuration of the middle ear.

24. According to ROHRER's examinations, made on a hundred patients with otorrhœa and ten with dermal affection of the external ear, there were found in the non-fetid otorrhœa only cocci, in the fetid discharge cocci and bacilli. The secretions of the acute cases contain only bacilli (72 per cent.), and after they had become fetid, cocci (28 per cent.). In the chronic forms 49 per cent. had cocci and 51 per cent. bacilli, etc. The dermal affections of external meatus and the auricle presented 82 per cent. cocci and 18 per cent. bacilli. Injections into the abdominal cavity of guinea-pigs with the cultures of pathogenic microbes gave negative results. The diplococci found in the dermal affections when rubbed into the epidermis produced an eczema.

25. In CHATELLIER's case only staphylococcus pyogenes albus and aureus were found in the discharge of the tympanum ; it is important to note that no air had access. Hence we may conclude that the discharge had contained the staphylococci from the beginning.

26. RING relates briefly the histories of four cases in which he attributes an acute attack of otitis media to the use of Roosa's pyriform bulb or Politzer's inflator. He is inclined to think that the trouble was brought about by the injection of germs contained in the sponge of the pyriform bulb into the middle ear by the force of the air current from the bag. Whether these germs were contained in the Croton water with which the sponge was moistened, or in mucus which may have been sucked into the bulb, he is undecided.

SWAN M. BURNETT.

27. A résumé of KIPP'S three cases is as follows :

CASE I.—Chronic purulent inflammation of the middle ear, both sides, acute exacerbation in left ear. Severe pain in mastoid process and head. Intense vertigo, bilateral horizontal nystagmus lasting four days. Loss of sense of smell. Recovery.

CASE II.—Acute purulent inflammation of the middle ear. Large, deep-seated abscess below apex of mastoid. Intense vertigo. Transient bilateral horizontal nystagmus caused by injection into abscess. Recovery.

CASE III.—Acute purulent inflammation of middle ear. Abscess of mastoid cells. Nystagmus caused by pressure on mastoid process. Recovery.

The author has no other explanation of these cases to offer than that it is probable that pressure was communicated by the chain of bones in the usual way to the semicircular canals (which were also probably not in a normal condition), and the irritation was reflected in some as yet unknown way to the centre controlling the movements of the eye muscles.

SWAN M. BURNETT.

28. POMEROY'S patient was a man of fifty-six, who had had otitis media suppurativa acuta, but had become convalescent. Some months later there was pain and swelling on the right side of the neck, extending to the shoulder, and elevation of the temperature. In a few days the eye on that side became affected and a pronounced suppurative irido-choroiditis set in, which finally led to the enucleation of the eye. The neck trouble became worse and finally an abscess was found beneath the trapezii muscles and opened. The ear trouble progressed well. There was no connection found between the tympanum and the abscess in the neck. The author is inclined to think that in his case the inflammation extended to the meninges and thence along the optic-nerve sheath to the eye.

SWAN M. BURNETT.

29. STONE reports a case of an aural polypus which presented special difficulties to its removal owing to its adhesion to the walls of the external meatus. The removal of the polypus was unsuccessful with the snare, but succeeded after the adhesions were severed, during narcosis, with the hollow chisel.

30. RICHARD'S patient was a girl of six years who presented the usual picture of polypus associated with chronic purulent otitis media. The polypus, which was red in color, like a blood

cyst, was removed with a snare, and found on examination to be a true angioma. The drum-head was depressed, but probably not perforated, and the hearing was restored.

SWAN M. BURNETT.

31. SUAREZ DE MENDOZA'S patient had otorrhea eleven years, epilepsy nine years, and formation of aural polypi six years. The epileptic attacks occurred three to four times a week, namely, in cleansing the ear, while washing, and when the patient changed his position during sleep. The author could even on slight pressure upon the polypus produce an attack. After removal of the polypi no new attack occurred.

32. THEOBALD thinks that the best method of using boracic acid in acute cases of otitis media, particularly where there is but a small perforation of the drum-head, is in the form of a saturated solution. The histories of five cases are given in illustration of the method of treatment. SWAN M. BURNETT.

33. BERMANN reports that he has been very successful in treating chronic suppurative otitis by means of the topical application of lactic acid. As the acid has great tendency to macerate the epidermis, he first coats the walls of the external meatus with a thin layer of paraffine. He then fills up the ear with a 30 or 40 per cent. solution of the lactic acid, and allows it to remain twenty minutes. It has a most marked effect upon the offensive odor even after the first three or four applications. When the discharge has stopped he uses insufflations of powdered boric acid.

SWAN M. BURNETT.

34. In certain cases of deep-seated inflammation of the auditory canal and mastoid cells, where it is necessary to establish drainage through a fistula, EMERSON has found the flexible catheter to fulfil all requirements. It secures free drainage, is sufficiently firm to be easily inserted, and yet flexible enough to adapt itself to the parts. Four cases are reported in which it was used with success. SWAN M. BURNETT.

35. TILLEY is of the opinion that inherited syphilis may be the cause of suppurative inflammation of the middle ear, and in cases of this kind always looks for the signs of inherited disease. If found, anti-syphilitic remedies are used in addition to the usual local applications. SWAN M. BURNETT.

36. After a brief allusion to the literature on the subject of chronic purulent inflammation of the attic, which is confined exclusively to America and Germany, BURNETT gives the histories,

in more or less detail, of ten cases, additional to ten reported elsewhere, principally in his "Treatise on the Ear." It is not a disease of childhood (one case in twenty), the hearing is greatly impaired in the chronic form, the discharge is thick, scanty, and very offensive. The "perforation whistle" is usually absent. The disease is difficult to cure, and the best form of treatment is cleansing and antiseptic, preferably peroxide of hydrogen and carbolic acid. The only way of washing out the attic and medicating it is by the tympanic syringe of C. J. Blake. Applications in powder do no good, but rather harm. SWAN M. BURNETT.

37. SEXTON advocates excision of the ossicles and membrana tympani in the manner already described by him for cases of chronic purulent inflammation of the attic. No cases are given, but the author states that his experience of three years with this operation leads him to hope much for it in this class of cases.

SWAN M. BURNETT.

38. HOFFMANN reports in the present paper his experience on pachymeningitis externa purulenta with reference to the opinion of other authors on this disease. It deserves, he thinks, more attention than was paid to it heretofore. Hoffmann collates 101 cases of ear diseases with fatal issue, with which inflammation of the dura mater was associated. In the living, four cases were observed by other authors, four by himself, whose histories are communicated. Among them is a case of cured sinus thrombosis. Hoffmann concludes his paper as follows: "The purulent pachymeningitis externa occurs most frequently among the intracranial affections, but on account of its indefinite symptoms it has not been recognized in the living except in a few cases. It forms most frequently the connecting link with the intracranial diseases, which almost invariably end fatally, viz.: with meningitis, sinus phlebitis, and brain abscess. These secondary diseases are favored by the long duration of the pachymeningitis and the retention of pus produced by it. When in otitis media the bone is affected one should think of the complication with pachymeningitis, if after opening of the mastoid process the dangerous symptoms continue or the symptoms of beginning meningitis or sinus phlebitis appear. The treatment should be operative, should mostly follow the opening of the mastoid, and consist in denuding the inflamed dura mater."

39. ROSSI discusses the different paths which the pus may take in caries of the temporal bone toward the interior of the skull,

and reports an interesting case. It was an acute otitis media without perforation of the drum-membrane leading to abscess upon the mastoid process and the entire side of the neck. On chiselling of the mastoid, caries of the sinus sigmoideus, and a subdural abscess were found, which were connected with the abscess of the neck. Rossi concludes from his observations that, when symptoms of intra- or extra-cranial abscess arise, the mastoid process should be chiselled and the pus be looked for also in the sulcus sigmoideus.

40. BACON'S case presented the usual history of purulent otitis media with formation of polypi and granulations associated with bone disease in a man aged thirty. Finally left fascial paralysis developed, and in the soft parts above the pinna an abscess was formed, which was opened. A probe introduced into this opening entered a cavity leading downwards towards the articulation of the jaw. Temporary relief followed, but a more extensive operation was decided upon and performed. Extensive necrosis of the anterior bony wall of the auditory canal and middle ear was found. The mastoid was opened with chisels, but found healthy. The cavity was drained and cleansed with bichloride. Patient improved for some days, then pains through forehead and side of the neck set in. He had aphasic symptoms. No chill, but increase of temperature. No optic papillitis. Dr. Weir called in consultation and thought there was probably an abscess in frontal lobe, but advised first a free opening in the mastoid. No trouble was found in the mastoid, but a large opening in the squamous portion of the temporal bone was found. An incision in the brain brought out half an ounce of pus. Later, Dr. Weir in attempting to make counter-drainage, as he thinks, wounded the middle cerebral artery, and the patient died probably from secondary hemorrhage. At the autopsy the entire bony auditory canal was found to have been destroyed.

SWAN M. BURNETT.

41. FULTON relates a case of primary acute inflammation of the mastoid in which there had been no preëxisting trouble of the middle ear. The bone was trephined, but no pus was found. The cells, however, were exceedingly vascular and seemed to be undergoing a sclerosing process. The patient was completely relieved. SWAN M. BURNETT.

42. FROTHINGHAM in his paper reviews the whole ground of mastoid disease and the indication for operation. He expresses

the views held by the majority of aurists in regard to an early operation, and prefers the chisel and mallet as the means of opening the bone. SWAN M. BURNETT.

43. SCHMIEGELOW reports the histories of thirty chisellings of the mastoid process. Twelve cases were acute processes and eighteen chronic inflammations. In six cases the dura mater during the operation was more or less visible at the bottom of the wound. In two cases an abundant bleeding occurred by injury to the lateral sinus. One of these patients died suddenly on the seventh day after the operation, probably in consequence of embolism of the pulmonal artery. In seven cases (23 %) only Schmiegelow succeeded in syringing to prove the existence of a communication with the middle ear. Three of these cases were cured, one died, in three the suppuration of the middle ear persisted. In about one half of the others the otorrhœa was cured, but not in the other half.

44. This editorial is a protest against the employment of the chisel for piercing the bone in diseases of the mastoid process. Saws or drills, worked by electricity, are recommended for this purpose. SWAN M. BURNETT.

45. BERGER, omitting all the cases with a superficial wound, or with injury to the brain produced by the ball piercing the ear, directs his attention to those cases in which a ball, closely following the course of the external auditory meatus, and destroying the drum membrane and the chain of ossicles, was arrested at the inner wall of the tympanic cavity, and had lodged there. The author believes that it is indicated under such circumstances to localize the foreign body and extract it. The procedure, when carried out with antisepsis, is harmless and cannot essentially interfere with the condition of the injured person. In order to procure direct and convenient access, it is commendable to detach the upper half of the auricle in such a manner as to turn it afterwards aside, as has first been done by Verneuile. The section runs almost through the attachment of the cartilaginous part of the auricle to the osseous auditory meatus; the length of the auditory meatus is diminished in this way about one half. If the path is not as yet sufficiently wide, the auditory meatus should be incised from the rear and the anterior limit of the apophysis of the mastoid process chiselled off. It then remains to chisel off with the instrument devised by Trouvé the ball, which should be done with the utmost precaution and the least possible force. In two

such cases with complete deafness the hearing power was not only completely restored, but suppuration, inflammation, and paralytic symptoms disappeared. Terillon has in one case in which the ball was lodged at considerable depth, employed the following expedient. He applied the trephine in a line closely corresponding to that of the auditory meatus, and removed the cells of the mastoid process, thereby tilting the ball over in such a way as to make it fall out. Recovery was extremely smooth. Desprès points out, that the extraction ought not to be attempted at the expense of extensive destructions, and he refuted all such procedures, as the ball is from the nature of the tissues in itself harmless. Berger advocates the immediate removal of the projectile, which improves considerably the chances for a favorable result. G. GELLÉ, Paris.

46. LAUTENBACH has found the internal administration of nitro-glycerine of value in cases of tinnitus, especially where there was a cardiac lesion, functional or organic, and where there was little or no loss of hearing. He gives it in doses of $\frac{1}{100}$ of a grain, increasing from one pill a day to six, if necessary.

SWAN M. BURNETT.

47. TANSLEY'S paper is quite lengthy, and a mere abstract would not do it justice, since he goes over the whole ground of nasal and post-nasal difficulties, all of which are liable to form a complication in ear diseases and generally as causes. He treats the subject under the following headings: 1. Any thing which wholly or partially occludes one or both nostrils. 2. Deviated septa. 3, 4. Œdematous tissue. 5. Hypertrophied tissue. 6. Nasal polypi. 7. Hypertrophied tissue peculiarly placed, but not necessarily occluding the nose. 8. Hypertrophied tissue exciting as well as mechanically pressing upon the Eustachian tubes. 9. Bands of tissue, seemingly cicatricial, stretching from the posterior wall of the pharynx to the Eustachian tube. 10. Atrophic or cicatricial rhinitis, with unusually patulous Eustachian tube. 11. Simple secretive catarrh. 12. Muco-purulent or hyperplastic catarrh. 13. Fibrous catarrh. 14. Ozænic catarrh, or catarrh with inspissated crusts.

Therapeutically the indications are: 1. To combat the blood dyscrasia. 2. To cure the catarrhally inflamed mucous membrane and restore its normal functions. 3. And if any thing the most important of them all, to free the nasal and naso-pharyngeal cavities from obstructions and encourage nasal breathing.

SWAN M. BURNETT.

48. It has been frequently discussed what part the ossicles play in the conduction of the sound waves through the tympanic cavity. A simple experiment shows that this part is a prominent one. If we sound a tuning-fork in front of a membrane, which is connected *e.g.* with the left ear, it is heard only on the left side, but if we then bring the membrane in contact with a solid body, which is connected with the right ear, it is perceived on the right side. From this simple proof it not only follows that the sound waves are better transmitted through solid bodies, as is taught by physics, but also that the ossicles play the most important part.

G. GELLÉ, Paris.

NERVOUS APPARATUS.

49. GRADENIGO, GUISEPPE, Padua. On the practical value of the electric examination of the acoustic nerve. *Allgem. Wiener med. Zeitung*, 1888, No. 44.

50. BAGINSKY, B. On Ménière's complex of symptoms. *Berliner klin. Wochenschrift*, 1888, No. 45.

51. MAGNAN and GELLÉ. Etiology of aural vertigo. *Soc. de Biologie*, April 7, 1888.

52. LANNOIS. Examination of two pretrous bones in a case of Ménière's complex of symptoms. *Soc. des scienc. méd. de Lyon*, 1888.

53. BURNETT, C. H. A case of aural vertigo (Ménière's disease) relieved by excision of the membrana tympani. *Trans. Amer. Otol. Soc.*, 1888.

54. BURNETT, C. H. Aural vertigo. *Medical News*, July 14, 1888.

55. BARATOUX, J. Changes in the internal ear in hereditary syphilis. *Trans. 9th Intern. Med. Cong.*, 1887.

49. GRADENIGO, with regard to the therapeutical value of galvanization in aural diseases, asserts that, even in apparently suitable cases (chronic processes of the inner and middle ear, otalgia, and continuous noises without objective and functional disturbances), he has never had results of any account and permanence, although electricity was employed in different persons for months every day. In the majority of cases of aural diseases Gradenigo produced temporary improvement. The galvanization is of much more importance for diagnosis and prognosis. Gradenigo thinks he may draw inferences from this as to the integrity of the

acoustic nerve or to the degree to which it is affected in the various morbid processes. It suffices in practice to determine the existence or absence of a reaction in medium intensity of the current.

50. From the fact that autopsies of cases of *intra vitam* intense vertiginous symptoms did not reveal any pathological changes in the semicircular canals and cochlea, and, on the other hand, revealed blood effusions into both cavities, where no vertiginous symptoms had existed, the author arrives at the conclusion that, in Ménière's vertigo, we have, in the greater part of cases, to deal with cerebral affections. Like his supposition that, according to his experiments, the cerebral lesion is in the physiological experiment the most important fact, *he believes* that foci of pus, inflammations, etc., at the bottom of the fourth ventricle, or in the course of their paths, injure the fibres of the acoustic and produce vertigo.

51. The authors found at the autopsy of a rabbit, which had suffered during life from aural vertigo, the external auditory meatus to be entirely obliterated. The middle ear was the seat of extensive suppuration with thickening of the mucous membrane by villous vegetations and osseous proliferations upon the walls. The stapes was immovably fixed in the oval window. Just as little as in the labyrinth were any changes found in the nervous centres. The symptoms observed during life were, therefore, produced by affections of the middle ear (*e. g.*, rotation of the neck, deviation from the position of the head, impossibility of changing the position without producing rotatory movements); for there was found no affection of the meninges which might be adduced in explanation. G. GELLÉ, Paris.

52. The patient, who suffered from an interstitial nephritis, offered during life the well characterized symptoms of Ménière's vertigo, with complete deafness. The petrous bones were first placed in osmic acid, then in a solution of chromic acid, and finally decalcified in a mixture of chromic and nitric acids. The small portion of the petrous bone presented an anchylosis of the anterior limb of the stapes in such a way as to allow the posterior part of the foot-plate of this bone to be easily pressed into the oval window, but not to allow in its entire circumference a movement outside the oval window, being firmly wedged in. There existed on the same side an additional distinct anchylosis of the ossicles and numerous fibrinous bands, extending from the capitulum of the malleus to the wall of the tympanic cavity. The set

of ossicles was also rigid in its whole extent. The cochlea under the microscope was found to be healthy, with the exception of the fibres of the lamina spiralis, which appeared somewhat rarefied after their exit. The left ear presented exactly the same changes, sclerosis of the middle ear, with absolute immobility of the chain of ossicles and anchylosis of the anterior stapedial portion with the margin of the oval window. The annular ligament was as hard as cartilage and the stapedial plate extremely thickened. The membrane at the oval window was hardened and appeared scarcely movable. In the labyrinth no noteworthy changes were found. This examination thus proves, in one case, that the symptoms of Ménière's vertigo are not always the result of an inflammation of the labyrinth, but that they may, on the contrary, be only associated with old purulent and sclerotic inflammations of the middle ear, and that the labyrinth may be only secondarily affected. G. GELLÉ, Paris.

53. BURNETT's case was in a woman, thirty-one years of age, who had lost much hearing power in the left ear in childhood from suppurative disease. Latterly there had developed a persistent high-pitched and annoying tinnitus, and still later a dizziness, for which she sought relief. Membr. tympani white, flattened, with the malleus adherent to the promontory, but otherwise free. Hearing 6 inches for the voice. The membr. tympani with the malleus and incus were removed in much the same manner as is done by Sexton under ether. The relief to the tinnitus and vertigo was immediate. There were no inflammatory reaction or other bad results. In course of time a new membr. tympani was formed. SWAN M. BURNETT.

54. In this paper, designed principally for the general practitioner, BURNETT considers the different ways in which Ménière's symptoms can be produced by affections in the external, middle or internal ear, the latter embracing the trunk of the nerve itself. He states that in one case of intense aural vertigo he got entire relief by Sexton's operation for removal of the malleus and incus. SWAN M. BURNETT.

55. BARATOUX in autopsies of hereditary syphilis in which the ears were affected, has found changes in the labyrinth alone in four cases. There was cellular proliferation of the membr. lam. basil., fibrinous clots in the vessels, and rupture of the walls. In all cases, in fact, there was present hemorrhage into some part of the labyrinth. SWAN M. BURNETT.

NOSE AND NASO-PHARYNX.

56. HOJECKI. The bacteria in acute and chronic coryza and in ozæna. *Berliner klin. Wochenschr.*, 1888, No. 33.

57. ROSSI, DE. Researches on the microörganisms in the Eustachian tube of healthy individuals. *Trans. 9th Inter. Med. Cong.*, 1887.

58. BISCHOFSWERDER. On primary rhinitis pseudo-membranacea. *Archiv f. Kinderheilk.*

59. LACOARRET, LÉONCE. Considérations cliniques sur le traitement du catarrh chronique des fosses nasales. Paris, 1888. Octave Doin.

60. BRONNER, ADOLF. The local treatment of empyema of the maxillary sinus. *Lancet*, August 25, 1888.

61. MCBRIDE, P. Empyema of the superior maxillary antrum, with only nasal symptoms. *Edinburgh Med. Jour.*, April, 1888.

62. SCHMIDT, MORITZ. Contribution to the diagnosis and treatment of the diseases of the antrum Highmori. *Berliner klin. Wochenschr.*, 1888, No. 50.

63. KRIEG, R., Stuttgart. Empyema of the antrum Highmori. *Med. Correspondenzblatt des Württemb. ärztl. Vereins*, 1888, No. 34.

64. LINK, IGNAZ, Lemberg. Clinical contributions to the operative treatment of empyema of the antrum Highmori, according to Prof. Mikulicz's method. *Wiener med. Wochenschr.*, 1888, No. 31.

65. HOPMANN, Cologne. Cure of a case of morbus Basedowii (Graves' disease) by improvement of a nasal affection. *Berliner klin. Wochenschr.*, 1888, No. 42.

66. BUCK, A. H. Reflex influences in the production of naso-pharyngeal catarrh. *Trans. Amer. Otol. Soc.*, 1888.

67. GRADLE, H. On headache from overlooked causes in the naso-pharynx and ears. *Jour. Amer. Med. Ass'n*, Sept. 8, 1888.

68. MOURE, E. I. Abcès aigu de la cloison des fosses nasales. *Revue mens. de laryngologie*, etc., 1888, No. 8.

69. MICHELSON, PAUL. On nasal syphilis. *Volkmann'sche Sammlung klinischer Vorträge*, No. 326.

70. McBRIDE, P. Methods of treating nasal and naso-pharyngeal polypi. *Edinburgh Med. Jour.*, Aug., 1888.

71. KIESSELBACH, Erlangen. On the presence of mucus in the nasal polypi. *Monatsschr. f. Ohrenheilk.*, 1888, No. 12.

72. KOEHLER, Posen. Two cases of rhino-scleroma. *Monatsschr. f. Ohrenheilk.*, 1888, No. 7.

73. JAKOWSKI, Warsaw. Second case of rhino-scleroma examined bacteriologically. *Gazeta Lekarska*, 1888, No. 27.

74. BRONNER, ADOLPH. Post-nasal growths and their relation to diseases of the middle ear. *Brit. Med. Jour.*, July 14, 1888.

75. WEIL, E., Stuttgart. On adenoid vegetations. *Württemb. med. Correspondenzbl.*, 1888, No. 37.

76. SCHAEFFER, Bremen. Bursa pharyngea and tonsilla pharyngea. *Monatsschr. f. Ohrenheilk.*, 1888, No. 8.

56. We find, according to HOJECKI's bacteriological examinations, very few bacteria (sarcina and a widespread diplococcus) in the normal nose. The more pus the discharged mucus contains and the longer the latter is retained in the nose, the larger is the amount and the number of the different kinds, especially where firmly adherent crusts have been formed. In acute coryza we find at first only one diplococcus of a large kind, which is soon overgrown and supplanted by from four to five different kinds, as, for instance, by Friedländer's pneumonia bacillus. In chronic rhinitis, also as a sequel to nasal stenosis, polypi, tumors, etc., the conditions are the same, only that staphylococcus pyogenes, and streptococcus of erysipelas are also found. In ozæna no specific infectious agent has been discovered up to date, in spite of the abundance of bacteria present in this condition. Only the microörganism which causes the peculiar fetor of ozæna has been determined and characterized as a bacillus extremely pernicious to mice and rabbits.

57. ROSSI obtained secretions from the Eustachian tubes of twelve healthy individuals, and found positive evidence of germs in six. In none were there found pathogenic organisms.

SWAN M. BURNETT.

58. BISCHOFSWERDER communicates several observations of croup of the nose, which agree with those published by Hartmann and Moldenhauer.

59. LACOARRET in his extensive monograph fully describes the various forms of chronic nasal catarrh. He distinguishes

three forms: simple coryza chronica, hypertrophic and atrophic coryza chronica. It is not within the scope of this review to enter into the details of the paper.

60. In four cases of empyema of Highmore's antrum treated by BRONNER the disease could be attributed in every one to a precedent nasal affection, and in none was the empyema caused by dental disease. Four histories of cases are communicated. Bronner arrives at the following conclusions: 1. The chronic empyema of the antrum is more frequent than is usually supposed. 2. In most cases no typical symptoms exist. 3. The empyema is the frequent cause of chronic and recurrent rhinitis, especially of the unilateral one. 4. The empyema may cause the typical symptoms of ozæna. 5. It is in most cases caused by diseases of the nasal mucous membrane and not by dental diseases. 6. The easiest and simplest method of treatment consists in opening the sinus from the nasal cavity, and not from the alveolar process.

61. MCBRIDE, in opposition to Bronner's views, believes that in by far the majority of cases dental caries should be considered as the cause of the empyema. McBride holds that injections from the middle nasal meatus are not advisable. He deems necessary a counter-opening in the alveolar process or one according to Mikulicz. Two cases treated by him are described.

62. SCHMIDT makes an exploratory puncture for diagnostic purposes by means of a hypodermic syringe between the lower turbinated body and the nasal floor. The canula is twice as long and thick as the ordinary needles, and the point is rounded off short. Of late he prefers a needle curved at the anterior end instead of a straight needle. When the puncture is successful the operation is made from the alveolar margin and offers nothing new.

63. KREIG has operated on 23 cases, viz., 21 from the processus alveolaris and 2 from the fossa canina; 8 of these were men and 15 women between the ages of 17 and 55 years. The duration of the disease varied from two weeks to eleven years. The author uses for operation from the processus alveolaris a cock-saw drill, 3 *mm* wide, which supersedes the expensive apparatus proposed, *e. g.*, by Ziem. A solution of table-salt suffices for injection.

64. LINK's four cases, treated according to Mikulicz's method, do not excite special interest, with the exception of the concluding note, which reads as follows: If we place a cylindrical, smooth,

small piece of wood, of a finger's length, with one end upon the hard palate closely above the second molar tooth, and percuss on its free end with the finger, we hear from an empty antrum Highmori a full and clear sound, which becomes dull if we fill the antrum with water. Obstructing the corresponding nasal cavity has no influence upon the percussion note.

65. HOPMANN'S reported cure of Basedow's disease refers to a case which has been communicated before in the year 1885. It is of interest, inasmuch as in this case the reflex neurosis was produced by a nose affected with rhinitis atrophicans ; the turbinated bodies, being absent, could not have been the cause of it.

66. BUCK is of the opinion that inflammations of the naso-pharynx leading to aural troubles are due in not a few cases to irritation in the gastro-intestinal tract, and he has had one case of persistent naso-pharyngitis associated with tinnitus, which resisted all the usual remedies, and was relieved only on the successful treatment of retroverted uterus associated with subacute parametritis.

SWAN M. BURNETT.

67. GRADLE thinks that a certain type of continuous headache, more frequently met with in children, is due to the diminished patency of the Eustachian tubes. He has also found headaches with obstruction of the tubes. SWAN M. BURNETT.

68. MOURE'S patient was taken ill after a cold with the symptoms of an acute coryza with chills, intense fever, and frontal headaches. The external part of the nose was extremely inflamed, the swollen mucous membrane bulging out of the nostrils. Erysipelas was suspected. Permeability of the nose was restored after the effusion of fetid sanguineous pus. Whilst the mucous membrane was about to apply itself to the nasal septum, the dorsum of the nose sank. In spite of an apparatus introduced for its support, Moure did not succeed in restoring the former shape of the nose. He points out that the development of abscesses of the nasal septum by a cold has not been observed up to date, whilst those produced by a trauma are more frequently observed.

69. MICHELSON sketches, in the paper under consideration, the present knowledge of the pathology and therapeutics of nasal syphilis. He quotes only a statement of Mouriac on the frequency of the affection, according to which it amounts to about twenty per cent. of the tertiary affections. The author opposes his own statistics to the assertion that treatment with mercury

predisposes to tertiary symptoms, since in half of his cases a specific treatment had not previously been adopted. With regard to the period which elapses between the primary infection and the development of the nasal affection, the time from the first to the third year is considered most dangerous: one half of the cases falls within this period. The question as to the occurrence of a rhinitis in the so-called secondary stage is left open. In the chapter on the pathological anatomy Michelson confirms Moldenhauer's opinion that the saddle-shaped nose is principally caused by shrinking of the connective tissue between the membranous and cartilaginous portions of the nasal bones; rapid atrophy of previously swollen turbinated bodies is, according to Michelson, characteristic of gummous rhinitis and the direct result of rarefying ostitis. The author recommends, in order to strengthen the diagnosis, a histological and bacteriological examination, but considers the experimental use of specific remedies permissible. The shape of the ulcerations seems to him to be very important: he considers the furrowed ulcerations, which run in a sagital direction along the septum, plainly pathognomonic of its syphilitic character. Therapeutically, he recommends the combination of the local with the general treatment: with regard to the former the author inveighs principally against the reckless use of injections into the nose; he recommends, however, the use of tampons moistened with antiseptic solutions and of iodoform; with regard to the latter, he deems that in severe cases the combination of iodide of potassium with the inunction treatment or injections of calomel-oil, is indicated. Michelson, although not directly opposed to Volkmann's scraping with the sharp spoon, considers, with others, this operation as not entirely devoid of danger, its reaction frequently being violent, and would therefore like to see it used only as a last resort in malignant cases.

70. McBRIDE describes the operation for nasal and naso-pharyngeal polypi. He rejects the use of the forceps, and operates chiefly with the cold, and in some cases with the galvano-caustic, snare. Apart from the fibrous and malignant naso-pharygeal tumors, McBride distinguishes those extending from the posterior extremity of the middle turbinated body into the naso-pharynx and those springing from the margins of the choanæ. The latter cannot always be removed with the snare in which case the forceps or the galvano-cautery should be substituted.

71. KIESSELBACH reports that in his examinations he could

prove the presence of mucine in all nasal polypi. It is true that we do not find therein any special mucous tissue, but the presence of mucus is due to the swelling of mucine contained in all connective tissues, as is the case in congestion, especially in newly-formed connective tissue ; indeed, the mucous membrane of the nose is frequently found œdematous in cases of formation of numerous polypi.

72. In the first of the cases, not very graphically described, the affection had existed twenty-seven years, and led to considerable enlargement of the nose (cp. illustration). The scleroma appears to have developed from an acne rosacea. In the last few years partial disintegration of the tumor had taken place. The second case, whose etiology could not be ascertained and which had existed two years, was cured with the flattened galvano-cautery. KOEHLER therefore "urgently" recommends the galvano-cautery. The first case was not operated upon ; other remedies were without avail. In both cases the affection was confined to the exterior of the nose.

73. The patient, a woman twenty-five years of age, from Russian Poland, was treated in the surgical department under Prof. Jarodynski. Six years previously she had noticed a small tickling crust in the nose, which she had scratched away. Soon after some small tumors appeared in the same place, which gradually obstructed the corresponding nostril. Two years previously similar tumors appeared on the external parts of the nose. She was then operated on, and could subsequently breathe well through the nose. Several months later the trouble recurred, and led to the following changes : Both nostrils are filled with cartilaginous tumors, the right being completely obstructed, the left permeable to a very fine probe. On the right side the tumor extends to the upper lip ; in either choana diffuse, hard infiltrations. (Reviewer had the opportunity of examining the patient, but could not discover the last-mentioned infiltrations.) The uvula is entirely absent. No further changes in the pharynx nor in the larynx. The tumors were removed with the knife, and the patient discharged. The bacteriological examination confirmed the clinical diagnosis : bacteria of rhinoscleroma were found. The author found the large cells described by Mikulicz to be missing in the specimens made from the secretion of the tumor, but he found them in small numbers in the sections and the hyaline bodies. Cultures were made in gelatine, agar-glycerine, and potatoes.

The pure cultures in agar-glycerine were injected in watery solution into the pleural cavity of four white mice with a negative result, the animals remaining healthy. The author, on account of these facts and his former views, reasserts that the bacteria of rhino-scleroma are not identical with Friedländer's bacilli, but show only a morphological similarity to them.

SREBERNY, Warsaw.

74. BRONNER discusses adenoid vegetations among 198 cases of diseases of the middle ear in children. He found 101, or more than 50 per cent., with adenoid vegetations. He removes the vegetations with Hartmann's curette. The advantages are: absence of pain, slight risk of injuring important parts, feasibility of operating without narcosis.

75. WEIL recommends Schütz' forceps for the removal of adenoid vegetations which in opposition to the ordinary instruments cuts in a sagittal direction.

76. SCHAEFFER states that the bursa pharyngea (viz.: what is meant as such by Luschka) is, according to Luschka himself and others, very rare, and occurs either congenitally as anatomical, or, according to Schwabach, as pathologico-anatomical abnormity. Among 6,000 nasal patients the author could diagnosticate the bursa pharyngea in 16. Its comparatively greater frequency, according to other authors, especially Tornwaldt, is explained as follows: In hypertrophy or defective involution of the tonsilla pharyngea, bridging of the longitudinal sulci, especially of the recessus medius of the tonsil, frequently takes place. The cavities thus formed, and some lacunæ of the pharyngeal tonsil (which, like those in the palatal tonsil, may lead to the formation of cysts), strikingly resemble a bursa in probing, particularly when the pharyngeal tonsil extends far down along the posterior wall of the pharynx. The author thinks, however, that for simplicity's sake the diseases of these cavities might be designated as bursitis. Moreover, he thinks from the frequent failure in their treatment that he is justified in concluding that the importance of this bursitis is much overvalued by Tornwaldt.

MISCELLANEOUS NOTES.

ADAM POLITZER, Vienna. Die anatomische u. physiologische Zergliederung der menschlichen Gehörorgans im normalen u. kranken Zustande. Stuttgart, Ferd. Enke. 1889.

By writing the above book: **the technique of dissecting the normal** and **pathological human ear,** the famous and indefatigable author has rendered an incalculable service to aural surgeons, anatomists, and physiologists. No part of the body is so difficult properly to investigate as the auditory organ; in none are the methods of examination so intricate, manifold, and laborious. Politzer's book of 245 pages, with 164 drawings in the text and one lithographic plate, is an excellent guide into all the details of anatomical aural investigation, describing and illustrating the appropriate instruments, the methods of removing the whole auditory organ from the dead body, with special directions for important points in morbid specimens. Then follow detailed descriptions of the dissection of the different parts of the ear, all possible sections to exhibit the topography of the ear and its neighboring parts, the methods of preservation of specimens, the anatomy of corrosion and the whole microscopic technique in detail, to decalcify, embed, cut, and mount specimens. That most difficult task, the histological investigation of the labyrinth, and the situation of the acoustic nerve and its roots and nuclei in the brain, are clearly described, yet not at a tiresome length. Any one desirous to make thorough investigations in the fundamental part of otology, will find in Politzer's book a reliable and complete guide. We should think that the work would be particularly welcome to our countrymen, the Americans, who have a natural predilection for what is positive in art and science, and who have not yet done much original work in this department.

H. KNAPP.

GHERARDO FERRERI. Indirizzo Pratico alla Diagnosi e Cura delle Malattie Nasali. Vallardi, Milan, 1889.

Dr. Ferreri's **Practical Guide to the Diagnosis and Treatment of the Diseases of the Nose,** Vol. xv. of Vallardi's Manuals, 337 small octavo pages, shows that in Italy as now everywhere, due attention is bestowed on nasal disease. The book is dedicated to the author's teacher, Prof. De Rossi, and chiefly destined for the use of students taking the first steps in this department. It presents the contents of rhinology in full, anatomy, physiology, rhinoscopy, etc., dwelling particularly on what is useful in practice. Rhinitis is described under the forms of acute, chronic, hypertrophic, atrophic, and infective. The nasal reflexes form a special chapter of twelve pages. Epistaxis, fractures, foreign bodies, tumors, adenoid vegetations, changes in the neighboring cavities, nasal syphilis, and some other subjects are fully described. The language is simple and clear. Foreign literature, specially the German, is extensively utilized. The book is surely what it promised to be, a practical guide, and it is a good one.

H. KNAPP.

CONTENTS OF VOLUME XVIII., NUMBERS 3 and 4.

1. Case of Cerebellar Abscess, Due to Ear-Disease, Successfully Operated upon by Dr. Wm. Macewen, Glasgow. Reported by Dr. Thos. Barr 217
2. Loss of Membrana Tympani, Malleus, Incus, and Stapes, with Good Hearing. By C. F. Clark, M.D., Columbus, Ohio . . 219
3. Contribution to the Physiology of the Soft Palate. By Otto Joachim, New Orleans, La. Translated by Arnold H. Knapp, A.B. . 226
4. Additional Botanical and Clinical Contributions to Otomycosis. By F. Siebenmann, Bâle. Translated by Dr. Max Toeplitz, New York. (With plate i. of vol. xix., German edition.) . . . 235
5. A Rare Case of Auditory Reflexes. By H. Steinbrügge, Giessen. Translated by J. B. McMahon, New York 274
6. Diseases of the Mastoid Process, with a Report of Cases. By Gorham Bacon, M.D., Aural Surgeon, N. Y. Eye and Ear Infirmary. (With four wood-cuts.) 280
7. The Improvement in Hearing Obtained by the Action of Intense Sounds in Cases of Ceruminal Plugs. By W. Kosegarten, of Kiel. Translated by Dr. J. M. Mills, of New York . . . 308
8. Investigations in Regard to the Influence of the Form of the Cranium upon Several Important Relations of the Temporal Bone. By Otto Körner, of Frankfurt-a.-M. Translated by Dr. J. M. Mills, of New York 310
9. On Atresia Auris Congenita. By Dr. Eugene Jöel, of Görbersdorf, Silesia. Translated by Dr. Felix Cohn, New York . . . 317
10. Miscellaneous Notes 325
11. Index 327

NOTICE TO CONTRIBUTORS.

The editors and publishers of the ARCHIVES beg to offer some suggestions to authors who propose to favor them with their contributions.

1. As original communications the ARCHIVES can accept only such papers as have never been printed nor are intended to be printed in other journals. If a preliminary communication on the subject of a paper has been published, the author is requested to state this in the letter accompanying his manuscript. It is understood that contributors to these ARCHIVES and editors of other periodicals will make no abstracts of the original papers published in this journal without giving it due credit for the same.

2. Authors will receive gratuitously twenty-five reprints of their articles. If a greater number is desired,—notice of which should be given at the head of the manuscript,—only the additional cost of presswork and paper will be charged to the author.

3. In preparing manuscript for the compositor it is requested that the following rules be adhered to:

a. Write on one side of the paper only.

b. Write without breaks, *i. e.* do not begin a new sentence on a new line. When you want to begin a new line or paragraph at a given word, place before it in your MS. the sign ¶.

c. Draw a line along the margin of such paragraphs as should be printed in smaller type—for instance, all that is clinical history in reports of cases, etc.

d. Words to be printed in *italics*, should be underscored once, in SMALL CAPITALS twice, in LARGE CAPITALS three times.

4. Authors may receive proofs for revision if they will kindly return them without delay. We beg however to remind our contributors that changes in the copy are equivalent to resetting, causing so much additional expense. We therefore request them, to make, if possible, no alterations at all in their MSS., or, at least, to limit these to what is of essential importance

ARCHIVES OF OTOLOGY.

CASE OF CEREBELLAR ABSCESS, DUE TO EAR-DISEASE, SUCCESSFULLY OPERATED UPON.

By Dr. WM. MACEWEN, Glasgow.[1]

A CASE has recently occurred at the Royal Infirmary here, in which, for the first time in the records of surgery, an abscess in the cerebellum has been reached by perforating the occipital bone and tapping the abscess with success. The patient was a young man of seventeen years of age, who had suffered for twelve years from purulent disease of the *left* middle ear. He was sent into Dr. Macewen's wards in an apparently moribund condition; he was unconscious, had an extremely weak and slow pulse, while his respirations numbered only ten per second. There was marked optic neuritis. No history could be obtained, as the friends left the hospital immediately after depositing the patient inside. The disease of the ear was detected, and a sinus was seen to exist behind the auricle. Dr. Macewen perforated, by means of a burr propelled by a dental engine, the cortex of the mastoid, opened into the antrum, and cleared out caseous-looking matter. He then exposed the lateral sinus, on which he found granulation tissue. With the same burr, Dr. Macewen then perforated the bone farther back than the groove for the lateral sinus, and on reaching and cutting through the membranes over the cerebellum, a quantity of pus escaped with considerable force through the opening. Altogether about four ounces of pus were liberated from the interior of the cerebellum. A decalcified chicken-bone drainage-tube was inserted, and antiseptic dressings applied. No anæsthetic was administered. Immediate improvement in the condition of the

[1] Note by Dr. Thomas Barr, Glasgow.

patient took place. The pulse and respiration increased in strength and rapidity, while consciousness returned. A month has elapsed since the operation, and the patient has made an excellent recovery. The dressings have only been renewed once, and that a fortnight after the operation, when the wound was nearly healed. After the operation, it was elicited that the symptoms observed before the man's admission to the infirmary were vomiting, great pain in the head, severe and frequent rigors and hemiplegia of the left side, the same side as the ear affected. Further details will ultimately be published.

LOSS OF MEMBRANA TYMPANI, MALLEUS, IN CUS, AND STAPES, WITH GOOD HEARING.

By C. F. CLARK, M.D., Columbus, O.

THE following case, aside from the curious demonstration which it supplies of the possibility of good hearing without the ossicles and membrana tympani, presents several points of interest in its clinical history, to which I would call attention.

Miss Katie F., a school-girl, aged fourteen, was brought to me on August 8, 1888, with a large, deep, sloughing ulcer of the lower cul-de-sac of each eye. These ulcers presented a deep, punched out appearance, with a slough separating in the centre, a reddish, inclining to a blackish base, especially on the side toward the sclera, and were covered with a whitish, purulent discharge.

On the right eye the ulcer confined itself mostly to the fold of the conjunctiva, while on the left it extended up on the sclera almost to the ciliary region but, while the episcleral tissue was infiltrated, I could at no time find evidence of real involvement of the sclerotic coat. Such an ulcer, of course, suggested the idea of chancroid, but neither the history nor subsequent course of the disease bore out this theory of its origin. She had been spending several weeks in the country, and after walking through a field, among high weeds, had been attacked with violent inflammation of the face and eyes, accompanied by severe pain and marked chemosis. Of the two physicians in the country who saw her while in this state, and treated her for a week or more before she was brought to me, one pronounced her condition erysipelas, and the other a result of poisoning. As throwing some light on the cause of this disease, I elicited the fact that in December, 1887, some six months previous to the beginning of the present trouble,

a cut of the thumb, received while cutting meat, was followed by violent inflammation, resulting in the separation of a large slough, with destruction of the periosteum and exposure of the first phalanx of the thumb. This was accompanied by what was termed "erysipelas," manifesting itself by swelling of the arm, and what she described as "crusts and scabs" of the face. As a result of this she had tenderness on pressure over the malar bones, indicating a chronic periostitis, which, in varying degrees of intensity, has been one of the marked characteristics of her case throughout. Upon examining the eyes, I found the upper lids healthy, the corneæ clear, the irides and pupils normal. The vision of the right eye was reduced to light-perception, but the ophthalmoscope revealed the nerve and retina in an apparently normal condition. A careful consideration of all the facts led her uncle, Dr. S., and myself to the conclusion that inherited syphilis, of which there was good evidence, was at least an important element in the case, and her constitutional treatment was directed against that disease. She was given the protiodide of mercury, atropia was instilled, the ulcers were stimulated with a solution of nitrate of silver and a solution of the bichloride of mercury—1 to 5000—was given, to be used as a solution in cleansing the ulcers.

This treatment, and dusting the ulcers with an impalpable powder of boracic acid, sufficed in a few days to check the ulcerative process, and they gradually improved. But, no sooner would we have the surface well healed, and begin to congratulate ourselves that at last our troubles were over, than suddenly, often in the course of a night, a cicatrix, which was covered with new-formed epithelium and seemed almost normal, would present itself as a deep, gangrenous ulcer, with a black slough in its centre, such as to excite the greatest apprehension as to the safety of the eye, and especially the danger of symblepharon. During the months from early in August to December this process continued, the ulceration alternating between the eyes, and seeming much more uncontrollable at her menstrual periods. In each case recovery was good, and only slight symblepharon and white cicatrices remained to mark the site of the ulcers. Vision was defective, being reduced to light-perception at times, but it varied greatly, and this in spite of the fact that a careful scrutiny of the fundus revealed no lesion of nerve or retina.

When at last, after four months of treatment, the ulcerative process was checked, her vision, which with proper glasses had been

normal, was found to be as follows: R E, $\frac{4}{14}$; L E, $\frac{8}{60}$. This has since greatly improved.[1]

The periosteal tenderness, which had been a constant symptom, became more marked about this time, and extended to the region of the right ear. My experience with the eyes led me to make an unfavorable prognosis for the ear. The following notes from my case-book will illustrate the progress of the disease after the ear was attacked.

December 9, 1888.—Examination reveals tenderness on pressure in the superior mastoid region, and in the posterior superior wall of the external auditory meatus of the right ear. Membrana tympani slightly retracted, but otherwise apparently normal.

December 10*th*.—The patient complains that there has been aching of the ear since yesterday with considerable hemorrhage. Loud-voice-sounds are now only heard within four inches of the ear, and on examination I find a focus of inflammation, with swelling and great tenderness in the superior portion of the external auditory meatus, near the auricle. The hemorrhage evidently came from the tympanic cavity.

December 11*th*.—Under the action of leeching and frequent syringing with hot water, the above symptoms were relieved and the condition of the ear greatly improved.

December 23*d*.—With the exception of slight tenderness at the apex, the mastoid tenderness has almost entirely disappeared under the above local treatment, with the constitutional treatment which was instituted when the eyes were first affected. The tenderness over the malar bone and the earache continue, and for two or three days past there has been a sero-sanguinolent, tending to a purulent, discharge. The extreme tenderness in the posterior wall of the external auditory meatus has disappeared, and the swelling has subsided so that a view of the membrana tympani can now be obtained. The membrane is pale, thin, and parchment-like, with two perforations in the central and lower portion.

December 28*th*.—Greatly improved. The ear is now free from pain, the secretion has almost entirely ceased under the use of

[1] On June 26, 1889, Vision, with the proper correcting glasses, was found to have increased to: R. E., $\frac{4}{5}$; L. E., $\frac{4}{5}$.

A careful study, with McHardy's self-registering perimeter, revealed, for the left eye, a normal visual field; while the right was irregular and was reduced to less than 35°.

At a still later period, August 5, 1889, after another similar attack of inflammation of the lower lid of the *left* eye, its vision was reduced to $\frac{4}{15}$, and its visual field to less than 45°; while the ophthalmoscope revealed no gross lesion of retina or nerve.

boracic acid, and for the first time I succeeded in inflating by Politzer's method.

January 7, 1889.—I was called to see the patient at her home, and found her in bed, where she had been for a week.

After her last visit to my office she had been free from pain until the following day, when she had severe pain in the ear, coming on without apparent cause. The pain became more and more severe and, owing to weakness and dizziness, she was obliged to take to her bed. There had been great swelling about the face and ear, but no discharge until to-day. For several days there had been paralysis of the right side of the face, immobility of all the muscles, mouth drawn to the left, eye staring wide open, etc., etc. The patient's mind was clear, there was no evidence of meningitis, (?) and I found on examination great tenderness of the cheek and over the mastoid region, and scanty discharge, owing to closure of the meatus by swelling and the presence of large, partially detached, leathery masses sloughing away from the auricle and external meatus.

The periosteal tenderness, and the blackish, gangrenous appearance of the ulceration established the fact that we here had to deal, as I had concluded when the ear was at first attacked, with the same process that had proved so obstinate in the eyes. Here, however, its course was modified by the nature of the tissues, but rendered far more dangerous and difficult to control owing to the delicacy of the parts involved and their inaccessibility.

After an hour or more of work with syringe, cotton-probe, and curette I succeeded in opening a narrow channel to the middle ear, and removing some exfoliated masses and a little blood-stained pus. I directed syringing with a solution of bichloride of mercury, with frequent cleansing of the ear by means of the cotton-probe, etc., and, in order to facilitate the removal of the partially exfoliated, leathery sloughs that were obstructing the external meatus, and thus to favor the discharge of the pus formed in the middle ear, I directed that a poultice be applied. Owing to the very imperfect outlet for pus and the virulent nature of the disease, as witnessed in the eyes, I felt great solicitude, not only for the hearing but for the life of the patient, and so expressed myself to the friends. Yielding to the importunities of the child, who naturally dreaded the pain accompanying treatment, they did not send for me again. Finding they could control the symptoms, as they supposed, by the syringing, they carried out the treatment at home, sending her to me again at the end of a month.

February 3d.—Returns much improved as to her general condition. Paralysis of the seventh nerve continues, but now is not complete as there is slight movement of the lid. Total deafness of the right ear; tuning-fork not heard on the right side. On examination I found marked tenderness over the right, with slight tenderness of the left side of the head. Intense tenderness about the mastoid, but no swelling. A small cicatrix over the mastoid indicates the spot where during her illness a small, superficial abscess was opened, allowing the escape of a small amount of greenish pus, which evidently came from the sub-periosteal inflammation rather than from the mastoid cells. The external meatus is still greatly obstructed. At a point about the junction of the cartilaginous with the bony meatus I found extensive denudation of bone, and a large opening downward and backward, through which I could pass a probe one third of an inch into what I at first supposed was the mastoid process, but which proved to be a cavity formed by sloughing away of the inner portion of the cartilaginous process. The loss of the greater part of the tragus was also discovered to have been one of the results of this destructive process.

February 10th.—After much tedious treatment in removing the necrosed tissue and allaying local inflammation I am now enabled to obtain a good view into the ear, and it presents a remarkable appearance. The rough edge of the osseous external auditory meatus is laid bare through the lower and posterior two thirds of its circumference. The inner portion of the cartilaginous meatus seems to be necrosed or drawn away so as to leave a large cavity. The osseous meatus is denuded throughout the same portion of its circumference as far as it can be seen; at least as far as the tympanic ring. To my surprise the patient states that she last night discovered that she could hear with this ear! For about ten minutes she had had a "heavy, digging" sensation in her right ear. She was lying on her left ear and could hear nothing with it, but she heard the clock strike and told her mother it was wrong for it only struck five, whereas it was twelve o'clock at night. I was disposed to doubt so curious a coincidence as the sudden restoration of hearing while the clock was striking the hour; but a careful test established the fact that, in spite of the extensive loss of tissue, she could hear conversational tones at fifteen feet. I find that now the function of the facial nerve is so far restored that the patient can by an effort close the right eye; and a peculiar feature of the case, is that, in attempting to close the eye, a small group of

fibres of the orbicularis seem to act alone, and the lower lid stands out erect and away from the eyeball at its inner two thirds. Treatment: syringing with carbolized water, careful drying, and cleansing with curette and cotton-probe, use of peroxide of hydrogen to cleanse the irregular, out-of-the way crevasses, drying, and the use of Wyeth's boracic acid with the salicylate of chinoline.

March 10th.—The patient now states that for the last two weeks she has had loss of taste on the right side of the mouth. This I confirmed by the use of salt on the tongue. One month previous to this time this was not the case, as I examined carefully with reference to it. The removal of the necrosed tissue seems to be complete, and a careful examination reveals the following condition: With the exception of a small area of the upper, anterior wall of the external meatus, no soft tissue is to be seen either in the bony canal or the tympanum. All is clean, ivory-like bone. The ossicles are absent,[1] and on the inner wall of the tympanum is to be seen the fenestra ovalis, and less distinctly, the fenestra rotunda. The outlines of the fenestra ovalis are clear cut and distinct, but it seems to be closed by a pellicle or membrane.

In spite of this extensive destruction of tissue, and the absence of so many parts often considered essential to any thing more than mere perception of loud sounds, I found that our patient had what might be termed *good* hearing. To be sure that I made no mistake, I took special precautions and made several careful tests and still found that she undoubtedly heard with her right ear, and repeated correctly conversation in ordinary tones at thirty-five feet and whispered words at sixteen feet.

May 3, 1889.—Since the above date the patient has been visiting friends in a distant part of the State, where her treatment has been conducted without the aid of the mirror, or other illumination than that furnished by the sun at a window.

She returns with hearing greatly reduced, profuse discharge, and polypi filling half the calibre of the external meatus.

Fearing that there might still be room for doubt as to the accuracy of my tests of the hearing of the right ear and the perfect ex-

[1] Later the ossicles were found lying loose in the tympanic cavity and were removed by syringing and the aid of the forceps. Their surfaces were eroded, and the processus gracilis of the malleus was absent. They had no firm attachments, and had lain concealed for weeks in the recesses of the tympanic cavity.

clusion of the left, I had awaited her return before publishing an account of her case.

My disappointment therefore was great on discovering that exuberant granulations had again been allowed to develop, which must of necessity interfere seriously with her hearing. To my surprise, however, she could still hear with the diseased ear.

With the finger firmly pressed into the left meatus she heard whispered voice at six inches, conversational tones at twenty-nine feet, and the tick of a watch at one inch=$\frac{1}{60}$. The tuning-fork on the vertex was also heard in the right ear, though heard better in the left.

A few days later, after removal of the polypi, I found hearing had increased so that she could hear the watch at six inches, = $\frac{6}{60}$, and she reported that she had been able to hear conversation over the telephone with the receiver applied to the right ear. With such extensive denudation of bone and, in spite of all treatment, the continuance in a subdued form of the periostitis which preceded the attack of otitis, one can hold out little hope as to the result. It illustrates, however, the possibility of a fair degree of hearing in the absence of all the ossicles ; and presents the unusual phenomenon of the separation of the stapes with the preservation of a membrane closing the fenestra ovalis and retaining the perilymph.[1]

[1] On July 29, 1889, another careful test of the hearing of the right ear was made with the following result : after careful closure of the left ear, whispered voice was heard at 43 inches ; watch test, $\frac{8}{60}$.

Closing the right ear and making the same test—the left remaining closed—no sound was heard.

CONTRIBUTION TO THE PHYSIOLOGY OF THE SOFT PALATE.

By OTTO JOACHIM, New Orleans, La.

Translated by Arnold H. Knapp, A.B.

PROF. B. FRÄNKEL kindly sent me a patient whose entire external nose and septum nasi was destroyed by disease. For several years the patient was used by Prof. Fränkel for *intra vitam* demonstrations of the nasal pharynx, the Eustachian tubes, and the processes of speaking, swallowing, etc. Such patients, in whom the functions have remained normal (even the sense of smell was perfect in this case), are, as Voltolini says, rare, and should be made the subject of detailed investigation. I gladly seized the opportunity to study these processes by ocular inspection, and to compare my own observations with those of others. In the perusal of the literature on the subject which Prof. Fränkel kindly placed at my disposal, I found that the opinions of authors were in many respects divergent, especially in regard to the completeness and manner of the closure of the isthmus pharyngo-nasalis during phonation, and in regard to the conditions of the orifice of the tube during deglutition and phonation. Passavant has extensively and critically discussed the views of different authors up to the time of his own paper, so that I only wish to quote some passages from later works in order to call attention to the still existing discrepancies of observation.

Passavant's results have been frequently doubted, and differently explained. He made his observations on Dr. Moritz Schmidt, on himself, and on patients with defects of

the palate. At the close of his paper he says: "By the simultaneous action of the levator palati and the superior constrictor of the pharynx, the horizontally raised part of the soft palate touches the advancing intumescence of the posterior pharyngeal wall, and thus the closure is effected." We find this still more emphasized in a later communication, in which he says: "The object to which I have sought to draw attention in my paper on the closure of the mouth during speech is the isolated action of the superior constrictor of the pharynx, its ridge-like projection behind the soft palate, both *antero-posteriorly and laterally, toward the centre,* producing the complete closure of the palatal valve, which is necessary to effect intelligible speech, while at the same time the soft palate is raised and drawn backward."

GENTZEN,[1] in an excellent paper, asserts that he has observed the transverse ridge. He says: "The posterior wall protruded in the form of a transverse prominence, exactly as Passavant has described. As soon as the letter ceased to sound the soft palate fell suddenly, and I could see at once how the posterior wall of the pharynx retracted and its folds smoothed themselves out."

VOLTOLINI, from the results of experiments, states as follows: "In speaking there is no complete separation of the naso-pharynx from the laryngo-pharynx, but a 'transverse ridge' is always formed." He considers the closure of the palate an essentially sphincter-like action, but acknowledges that the transverse ridge is not always visible, even that it cannot at all times be observed in the same individual.

THECHNER[2] says: "Articulation is not effected by this alone, but from the wall of the pharynx a ridge projects, as Passavant first observed. I can prove this fact from my rhinoscopic observations."

VOGEL,[3] in his paper, agrees with the views of these authors: "Simultaneously with the elevation of the soft

[1] "Observations on the Palate After Removal of an Orbital Tumor," Königsberg, 1876.

[2] "Phonetics," p. 29.

[3] "Observations on the Pharynx of a Man with a Complete Defect of the Nose," Dorpat, 1882.

palate we observe that the posterior wall of the pharynx projects forward, so that both join. By suitable illumination we plainly see, especially if a short *a* is pronounced in the moment at which the soft palate falls again, a simultaneous retrocession of a ridge on the posterior wall of the pharynx, the greatest conversity of which is somewhat under the level of the hard palate on the lower edge of the pharyngeal tonsil.

Opposed to these views are MICHEL'S [1] observations. In a case similar to ours Michel was unable to confirm the presence of a transverse ridge. The results which he has arrived at through rhinoscopic investigations are: "That the formation of the transverse ridge is the exception, and not requisite for articulate speech. It does not depend merely upon the action of the superior constrictor, but on a powerful co-operative movement of the posterior wall and the pillars of the fauces, so that the transverse ridge is a pathological appearance of a compensatory nature, as in case of defective palate or conditions of paralysis." He claims to have observed two longitudinal ridges in his patients during deglutition, without, however, giving us complete information on this point.

LUCÆ,[2] in his case, has, it seems, also been unable to observe a transverse ridge. He says: "During the simultaneous narrowing of the Eustachian tubes the soft palate takes a horizontal position to the posterior wall of the pharynx."

In opposition to Voltolini, HARTMANN [3] came to the conclusion, by delicate manometric investigations, that closure during phonation was complete. Even if only a minimum pressure, for instance (20 *mm* of water in the nostrils), is used, the position of the manometer remains constant as long as the phonation lasts, with the exception of *a*. In seven persons in whom the condition of these organs could be considered normal, pressures of from 30 to 100 *mm* of mercury were necessary to overcome the

[1] *Berl. klin., Woch.*, No. 41, 1875.
[2] *Virchow's Arch.*, lxiv.
[3] *Centralbl. f. d. med. Wissensch.*, No. 15, 1880.

resistance of the soft palate during the formation of a vowel.

B. FRÄNKEL,[1] however, is of the opinion that no hermetic closure of the isthmus exists during phonation, but that more often the air column in the buccal and nasal portions of the pharynx remains continuous; the velum palati in particular does not apply air-tight to the lateral parts. We find equally opposed views on the relations of the orifices of the Eustachian tubes, during deglutition and phonation, TOYNBEE, POLITZER, MICHEL, TRÖLTSCH, and others, in consequence of their observations and experiments, agreed with the opinion of Valsalva, that the tube is opened during the act of swallowing. Lately *Zaufal*[2] has adopted the same standpoint,[3] and illustrated it by photographic views of the orifices of the tubes, taken during the acts of swallowing and phonation. LUCÆ[3] opposed this, both in word and writing. VOLTOLINI, who in his work critically discussed the papers of Michel, Lucæ, Zaufal, and others, arrives, by his experiments, at Valsalva's views. Hartmann[4] by a series of detailed and very instructive investigations in the pneumatic cabinet has proved this supposition to be a fact.

The patient who furnished me opportunity for observation, a tall strong man, 38 years old, acquired syphilis about 12 years ago. He stated that during the last 5 years he had lost his nose. For several years he had been under clinical treatment, and healing did not take place until after the removal of large sequestra and repeated scraping operations. His entire outer nose, the whole septum, on the left side all the turbinated bones with the exception of a remnant of the superior, on the right the superior and the inferior, were lost; the oval opening is bounded on the left side by the superior turbinated bone, the orifice of the tube, the lateral wall of the naso-pharynx, a cicatricial mass lining the antrum of Highmore,—the partition wall between the nasal cavity and the mouth is also

[1] Uber adenoide Vegetationen, *Deutsche med. Woch.*, No. 41, etc., 1884.
[2] *Arch. f. Ohrenheilk.*, ix., pp. 133 and 228.
[3] *Virchov's Arch.*, lxiv.
[4] "Experimentelle Studien über die Funktion der E. Röhre," Berlin, 1878.

lost. On the right the partition between the antrum and the nose, as well as the middle turbinated bone, is preserved. Although large pieces of the hard palate are lost, there is no perforation of the inferior wall, and the large cavity is bounded below by the hard and the soft palates behind by the posterior wall of the larynx. The upper lip is thickened, but entirely capable of performing its function. The preserved mucous membrane now presents a nearly normal appearance, so that the patient has submitted to an operation for the restoration of his nose.

The loss of soft parts and bones which the patient has suffered is so great, that the naso-pharyngeal cavity is most conveniently visible from in front through the large opening; the Eustachian tubes, for instance, appear as if they lay outside on the face. The orifice of the left tube is occluded and impervious, with a considerably reduced power of hearing on that side. The tonsil of Luschka is greatly atrophied. The fossæ of Rosenmüller are flat and form a shallow transition from the posterior to the lateral wall of the pharynx, forming slight folds during phonation. The anterior labium of the tube passes obliquely backward and downward into the superior surface of the soft palate, while the posterior labium can be followed with the mirror as a muscular cord to the posterior surface of the uvula. During the elevation of the palate the prominence of the levator palati pushes itself between the two labia, yet does not completely block the orifices of the tubes, so that a circular opening remains between the walls of the orifices of the tubes and the highest point of the prominence of the levator palati, the axis of which does not correspond to the tubal cleft in the position of rest. During phonation the mouths of both tubes face each other. The patient can smell perfectly well, and his speech shows neither a nasal twang nor an altered resonance. During rest the soft palate slopes from its insertion steeply downwards, and disappears from view. With a mirror, introduced as far as the wall of pharynx, a convex uneven surface is shown with a tuberculum over the base of the uvula; on both sides an elevation of the levator palati, as well as the above-men-

tioned cords, which pass from the posterior lip of the tube to the posterior surface of the uvula, is noticed. The interval between the soft palate and the posterior wall of the pharynx is so great as to expose, in a favorable position, the posterior half of the vocal cords. The uvula itself is bent forward, and not visible. In quiet breathing the soft palate remains unaltered in this position. Prolonged examination discovers an irregular twitching here and there. In deep breathing, with the mouth closed, there is usually no irregular movement to be seen; often, however, an elevation of the velum palati to the level of the hard palate can be noticed in deep inspiration, as well as in forced expiration. When the mouth is open these appearances are rarer and much weaker.

Regular *movements*, varying, however, in intensity, occur particularly in phonation and deglutition, also in coughing, retching, yawning, etc. When I requested the patient to phonate, which usually was done with the sounding of an *o*, I first noticed the elevation of the soft palate at its place of insertion, the point which had to make the shortest excursion. In this point I differ from the observations of Michel and Vogel, who allege to have seen in phonation the first movement at the orifice of the tube. The soft palate is raised entire, but as the posterior parts have to go over a greater distance, the elevation appears wave-like. The intumescence of the levator palati increases during this process, and, so to speak, crowds between the lips of the orifice of the tube, whereby principally the posterior lip moves back and up. I could perceive a minimum forward motion only in the lowest part of the anterior lip, and not before the elevation of the ridge of the levator palati. This observation agrees with that of Lucæ, excepting that in my case the backward movement seemed to have been smaller; it is, however, different from that of Michel, who noticed that the lower ends of the orifices of the tube approach the centre of the head of the pharynx. Vogel's observation differed from mine, inasmuch as he perceived the first movement at the orifice of the anterior lip. From the observations made on this patient I came to the conclu-

sion that the *tube opens during the act of swallowing*, as it was possible to look deeply into the gaping ostium, when the patient was examined for a length of time, during which the mucous membrane would become dry.

In the position of rest the lips of the orifice of the tube are in contact in their whole extent, and the cleft is turned forward. When the soft palate has reached its highest point, it lies more or less close to the posterior wall of the pharynx and above the level of the hard palate, remains in that position without any perceptible motion during phonation, and, *in toto*, sinks entirely back to its place of rest at the cessation of speech.

I have taken especial pains in this patient to examine the relation of the soft palate to the posterior wall of the pharynx during phonation, deglutition, etc. Passavant's ridge was present in my patient, though not developed to a marked degree. It was best visible in short vocal sounds, and appeared as fine stripes on the posterior wall of the palate opposite the ridge at the basis uvulæ. The closure of the naso-pharyngeal cavity was aided on the sides also by the protrusion of the lateral wall of the pharynx. The closure never was complete during the sounding of the vowel *a*, and the soft palate never reached the level of the hard palate. In the sounding of *e* and *o*, the soft palate was in contact; left, however, a small cleft on both sides of the tuberculum veli. This cleft became more apparent after longer examination, through the drying of the mucous membrane. The sounding of *i* and *u* produced complete closure. The soft palate rises to complete closure in the pronunciation of a consonant without the accompanying vowel, except in the case of *m*, *n*, and *h*. I did not repeat the experiments of Passavant on Dr. Moritz Schmidt, for I could satisfy myself by direct observation that in the sounding of *a* no complete closure was produced, while in the case of *i* and *u* the closure was always perfect. With *e* and *o* the closure was not so complete.

To determine the height to which the soft palate is raised during phonation, deglutition, etc., I repeated the experiments of Gentzen and Vogel with a similar lever apparatus

and Marey's drum, which were kindly placed at my disposal in the Physiological Institute at Berlin by Professor Gad. The results which I obtained by the tracings of this very sensitive instrument agree in general with the results obtained by other authors. The greatest elevation was produced in the vowels by *u*; *i*, *o*, *e*, and *a* following in the order named. A *u* sung with steadily increasing pitch shows the upper line unchanged in the same level. Also in the other vowels it could not be ascertained that the pitch of a tone had any influence on the elevation of the soft palate. *Lucæ* is not of this opinion, but thinks that a higher pitch of a sound produces a raising of the soft palate. The diphthongs *ai*, *ei*, *oi* do not raise the soft palate so high as *i* does, whereas *ui* raised it higher. In the pronunciation of vowels with succeeding or preceding consonants, the line ascends without interruption to the summit, and falls straightway in the same manner. I could not notice a stay of the soft palate at the height of the corresponding co-vibrating vowel, as has been described by Gentzen.

Vowels pronounced with a nasal twang raise the soft palate, but do not produce a closure. *M* and *n* do not occasion a change in the place of rest of the soft palate; *h* does not raise it. I cannot confirm the remarkable differences which Vogel found in the pronunciation of the different consonants. *T* produced the largest excursion. *K*, *g*, and *d* almost reached the same level. The remaining consonants show little difference between themselves and those just named. *L* produced the smallest excursion. *R* made the soft palate visibly vibrate, and the vibrations could easily be counted with the magnifier. The pronunciation of words with many vowels produces a curve, with an irregular upper line; when, however, *m* or *n* is present in a word, the soft palate falls almost to the places corresponding to those consonants, almost to its position of rest. Deglutition produces an elevation of the soft palate above the height of phonation, but neither before nor after it was I able to observe still deeper a sinking, as Gentzen has done. The ascending line is more oblique than in the case of phonation; the descending line shows a rest in the middle, after

which the soft palate returns more slowly to the place of rest. The photographic pictures were taken during empty swallowing. Coughing produced a curve very similar to that of *k*. Attempts at snoring formed an excursion somewhat less than coughing. Retching caused the highest excursion of the soft palate ever noticed. A marked negative excursion (sinking below the place of rest) was noticeable during sighing.

These values were obtained by laying on the middle line of the soft palate a wire that was curved upwards. Less reliable results were obtained by applying an eyelet, which covered the greater part of the soft palate. I have examined my patient with regard to these points, and can confirm in general the reports of other authors. Nevertheless, they differ in some points. From the observations which I was able to make, I came to the following conclusion: that the soft palate influences speech only by separating the mouth from the nasal cavity as far as it is necessary for the formation of speech; moreover, that the loss of the nose does not impair its function as a resonance-box.

ADDITIONAL BOTANICAL AND CLINICAL CONTRIBUTIONS TO OTOMYCOSIS.

By F. SIEBENMANN, Bâle.

Translated by Dr. Max Toeplitz, New York.

(*With plate i. of vol. xix., German edition.*)

THE human ear proves more and more to be a mine of pathogenic fungi. Strange to say, as is apparent from our synopsis, the kinds and species first therein discovered are now found more rarely, and in their place a number of others, to a certain extent already known for some time as pathogenic, play a prominent part. Hence we receive the impression that with the increase of our mycological knowledge additional botanical discoveries can here still be made, and that we should as yet not be satisfied with the knowledge thus far acquired in this field.

In the year 1883 I published, with the kind aid of the late and deeply lamented Prof. A. Burckhardt-Merian, an extensive monograph upon the occurrence of moulds in the human ear, upon their position in the botanical system, their biology, and their metabolic changes upon dead material and in the living body. I took from my own material and that of others only the Eurotia and Aspergilli, principally because this genus was at that time botanically well-known.

By the kind request of my highly esteemed teacher and colleague, Prof. Bezold, of Munich, I shall publish in this paper those of his cases of the last six years which belong to this subject and are kindly placed at my disposal, and shall without selection treat statistically of all the cases.

Prof. Bezold, as is known from his writings, has at all times paid much attention to otomycosis, and has thus seen during this period fifty-two well observed cases in which fungi were microscopically looked for, after the diagnosis had been macroscopically ascertained.

The specimens of moulds, as many as were obtained, well preserved mostly in glycerine or alcohol, belonged to the corresponding histories of cases, and were carefully examined. The result of this re-examination is discussed in a special part, which I place at the head of the paper, since it offers the most additional knowledge.

CASE 1.—A. S., from the country, æt. 37.

January 20, 1881.—For three to four years hardness of hearing; two maternal relatives hard of hearing. On the left side for four weeks, after an eruption of the face and head, pain in the ear, for which a week ago oil was instilled. The last few days there exist discharge, increased hardness of hearing, and intense pain.

An epidermis ring, coated with aspergillus fumigatus and saturated with oil, is removed with the syringe. Further treatment consists in instillations of a two-per-cent. solution of salicylic alcohol into the ear three times a day for ten minutes, and a daily injection of solution of boric acid. All other patients reported in this paper underwent the same treatment, unless another method is expressly stated, so as to enable us to omit further mention of this treatment in the following histories of cases.

CASE 2.—George B., æt. 40.

February 3, 1881.—For two days discharge and hardness of hearing in the left ear. Relapse of otorrhœa, without pain. Discolored, partly brownish, partly whitish masses were removed from the bottom with the syringe. The result of the microscopical examination is as follows:

Much free fat; numerous round, colorless spores of different size; mycelium, with enclosed fat globules, partially of great abundance; much branched, thick fruit hyphens, with pretty thick walls, and with formations of septa occurring more frequently near the fructifications, at places deep-brown coloration of the wall. First development of the fruit bearers, with a thickening upon which several root-like, short, rounded mycelium threads are situated. The hyphens show here and there swellings in their

continuity; these places as well as others enclose deep-brown spots, which seem at the walls to project inwardly. On their extremities the hyphens bear one, or, when branching, two or three capsules. The latter are mostly oval or round, pale, brownish, frequently torn or folded. The great majority are empty. Some are dark-brown, and enclose spores.

CASE 3.—Miss B., æt. 58.

April, 1881.—Otorrhœa for 12 years. Instillations of oil for six years for relief of tickling. One and a half years ago "black membranes" were removed with syringe. A day previous to consultation two little gray membranes came out of the ear. The syringe removed from the bottom similar gray, partly sanguinous shreds, which consisted microscopically of an abundant very delicate mycelium net, full of fat globules. On treatment with salicylic acid no relapse occurred during the following twenty days.

In May, 1882, the patient presented herself again with otitis externa of the same ear, associated at times with pain, some discharge and œdema of the external auditory meatus. The discharge, consists mostly of numerous short rod-like bacteria (my examination of this specimen resulted in complete absence of hyphomycetes). After injecting and powdering with iodoform the discharge ceased.

Later, in December, 1882, an aural furuncle on the right side was treated.

CASE 4.—X. v. H., æt. 26.

May, 1881.—The patient suffered from discharges as a boy. Bilateral residues of otitis med. pur. with persisting perforation. Instillations of oil for one year.

Both meat. aud. ext. are filled at the bottom with crusts, which are covered by a small aspergillus with little heads bearing small whitish spores.

CASE 5.—G., æt. 35, from the country.

July 9, 1881.—Bilateral otomycosis after instillation of oil. External meatuses swollen and diffusely reddened, and also part of the drum. The aural affection existed 6 weeks, instillation of oil made for 4 weeks. Small form of aspergillus with oil masses within and without the mycelium; small oval spores.

CASE 6.—L. H., æt. 42.

July 12, 1881.—On the left aspergillus fumigatus after instillation of oil.

July 15th.—New moulds are found.

CASE 7.—A. H., æt. 24.

September 19, 1882.—On the right side otit. med. pur. chron. Three days ago instillation of oil, pain in the ear since then, especially upon pressure on the auditory meatus; at the bottom of this a plug is found, which is softened until the following day.

November 20th.—The pain has ceased, a plug with aspergillus niger was removed with the syringe.

December 3d.—Formation of moulds disappeared. Defect of the posterior half of the drum membrane. Discharge has ceased. Hearing power not improved.

CASE 8.—S. T., æt. 36, from the country.

November 18, 1882.—Bilateral hardness of hearing. On the right ear what appears to be a ceruminal plug. This is softened and removed the following day. It consists in its outer part of cerumen. The inner portion is a black mass surrounded by numerous white lamellæ. Large clusters of spores and fruit bearers, aspergillus niger; the latter, partially filled with fat, are revealed by the microscope. No heads and no mycelium. [The patient six months ago had poured into the ear oleum amygdal. several times with a coffee spoon.]

CASE 9.—J. B., æt. 60, from the country.

Bilateral destruction of the drum-membrane, save a small upper remnant. Discharge and hardness of hearing for 40 years after "mucous and nervous fever" (typhoid existed). The tympanic walls exhibit at present moderate redness. Both meat. aud. ext. lined with dried secretions bearing a white coating. The latter consists of colorless spores and thin mycelium, containing a few fat globules.

CASE 10.—Lt., æt. 28.

March 7, 1882.—Pain in the left ear for a week; serious discharge lasting 4 days. A week ago and the following days, frequent instillations of ol. amygd. on account of the pain. Last night increase of pain so as to cause sleeplessness. Asperg. niger and extensive deposits of epidermis upon the meat. audit. ext., and upon the drum-membrane.

March 8th.—A few flakes of pus.

March 9th.—The same condition. Extensive swelling of the cartilaginous ext. meat., obstructing it to a chink. At the upper wall a furuncle is emptied.

March 10th.—Another furuncle; the same condition on the 12th.

March 14th.—Profuse suppuration and formation of croupous membrane.

March 15th.—Additional furuncle.

March 18th.—Suppuration has ceased.

March —th.—Hearing for watch normal.

CASE 11.—Dr. R., æt. 38.

April 28, 1882.—Bilateral ceruminal plugs; softening.

March 29th.—Microscopical examination revealed fructifications and mycelia of asperg. fumigat. Last August instillations of oil had been made.

April 11th.—Normal condition.

CASE 12.—G. W., æt. 62, from the country.

May 26th.—Hardness of hearing on the left ear for 20 years. Four weeks ago instillation of oil. Two weeks subsequently impairment of hearing, associated with serous discharge and itching. The last two days intense pain in the entire left ear, sleeplessness, and impossibility of masticating. The cartilaginous extern. meat. is swollen. Upon the drum-membrane whitish yellow deposits consisting microscopically of aspergill. niger.

June 1st.—Relapse, with small head-bearing, thin-membranous, and thimble-shaped casts.

June 6th.—Ext. meat. free from aspergillus.

CASE 13.—Mrs. L——, æt. 45, from the country.

July 20th.—Patient suffered from discharge as a child and three years ago. At the latter period instillations of oil were made. Discharge has lasted now eight weeks and is associated with pain and itching. With the appearance of the discharge additional instillations of oil were made.

Asperg. fumigatus is found with the microscope in the secretions. The following day no itching.

CASE 14.—D. æt. 39.

September 15, 1882.—Six weeks ago moderate discharge and tickling in the left ear without real pain.

August 25th.—A white glove-shaped mass was removed with the syringe from the left ear. Two weeks ago cotton soaked with oil was placed into the ear, and also three days ago.

Both meatuses contain whitish masses and at the bottom creamy fluid which exhibits microscopically large masses of micrococci. Offensive odor of the secretion. The removed masses contain mycelium with fructification of asper. fumig. By September 19th the ext. meat. is dry.

CASE 15.—K., æt. 41.

October 13th, 1882.—Bilateral inflammations beginning in the spring with frequent relapses and alternate discharges from both ears. At each attack sleeplessness for a few days and humming noises in the ear. These appearances presented themselves anew five days ago on the left ear. The removed masses consist of mycelium without fructifications and of bacilli and also of pus cells. Hearing almost normal. Instillations of oil had not preceded. Patient works in a flax- and hemp-spinning establishment, where he is exposed to much dust.

CASE 16.—K., æt. 40.

November 2, 1882.—For four weeks swelling in the right ear and watery discharge. Instillations of oil, not until two days ago. Aspergillus fumigatus, in the mycelium of which no oil can be found. On the 27th normal conditions are recorded, also concerning the hearing distance.

CASE 17.—Dr. ——, æt. 57.

January 25, 1883.—Nine months ago instillations of a solution of iodine and iodide of potash in glycerine were made into the right ear on account of subjective noises, and also two days ago. In the right meat. oss. a white-coated plug is found, after the removal of which the drum-membrane appears somewhat dull, otherwise normal. The white masses consist of mycelium and colorless spores. Upon the external surface of the mould-membrane I found at places a finely granular dark thin layer, in which the brown club-shaped conidium bearers and also partly preserved small heads of aspergillus nidulans were found.

CASE 18.—E. H., æt. 28.

April 13, 1883.—Ol. hyoscyami and chloroform āā were prescribed to the patient, with the order to place cotton plugs soaked in this solution into the external meatus.

December 14th.—Frequent instillation of the oil. A week ago tickling and a discharge for a short time. Day before yesterday intense pain in the ear. A thick epidermis cast containing aspergillus niger was removed with the syringe.

December 16th.—The pain has ceased.

CASE 19.—S. D., æt. 25.

June 7, 1883.—Otomycosis dextra.

For two years or more, 3 to 4 times a year, a slight discharge, tickling, and sensation of stopping up in the right ear, which suddenly passes away.

Epidermis of the right ext. meat. macerated and soaked with serous discharge. Drum-membrane appears dark and free from deposits. Handle of the malleus visible. Small brownish lamella bearing much gnarly mycelium abounding in fat granules and with conidia is removed with the syringe, and also numerous bacteria.

July 8th.—No discharge from the ext. meat.

CASE 20.—K., æt. 58; gardener.

June 10, 1883.—For 4 to 5 years impairment of hearing. A year and a half ago a bilateral discharge, somewhat fetid, appeared. K. has placed into the ear for a year cotton soaked in oil twice a week. The offensive discharge was at times removed with the ear-spoon in large pieces. The syringe removed to-day mucous dirty-yellow masses containing Verticillium and "Graphium penicilloides," and also large masses of bacteria.

CASE 21.—Ak., æt. 40.

September 20, 1883.—Bilateral otomycosis. Patient has instilled rancid "ear-oil" with a small glass syringe for six months every two weeks. Since that time, frequent tickling in both ears. Three months ago he removed a mass the size of a pea from the right ear without having a discharge. For four days the patient noticed impairment of hearing on the left ear, a sensation of its being stopped up.

The syringe removed fat and masses of epidermis with abundant dendriform, thick mycelium without fructifications. Under the microscope abundant delicate mycelium, which appears in all its loops imbued with fat; the darker portions contain very numerous small heads of aspergillus fumigatus.

October 5th.—Cured.

CASE 22.—D., æt. 28, from the country.

Four weeks ago sudden pain in the left ear. The same day profuse discharge of a brownish fluid. The pain disappeared the following day; since that time the tickling persisted. After a week the discharge became yellow. For two weeks the patient instils oil into his ear.

December 30, 1883.—The external meatus is filled by a yellow, cheesy, extremely fetid mass. The secretion consists of epidermic detritus, pus corpuscles in disintegration, and a fair amount of mycelium threads, which enclose many air bubbles and many oil globules. The threads themselves are irregularly thick, gnarly, and branched.

CASE 23.—M. F., æt. 57.

June 10, 1881.—Bilateral seguels of ot. med. pur.; in addition otomycosis dextra after instillation of oil, which does not cause any symptoms.

CASE 24.—Z. A., æt. 61.

June 10, 1881.—Otitis media purulenta chronica with extensive perforation in both ears. In the right ear upon dried secretion whitish flaky masses of mould. In the left ear, large cheesy, gray-yellow masses are removed with a syringe. (Patient had made two years ago instillations of oil into both ears.) Formation of mould without causing any symptoms.

August 2d.—Abundant masses of epidermis and slight purulent secretion. In the secretion no mould elements.

CASE 25.—L., æt. 18.

November 28, 1882.—Otomycosis sinistra. For two years tickling and discharge in left ear, principally in the fall. Yellowish mass situated in front of the promontory consists almost exclusively of functifying mycelium of aspergillus fumigatus.

CASE 26.—M., æt. 37.

January 6, 1884.—Complete deafness in both ears since 1877. Three months ago an ear-oil was instilled. In the left ear upon a thin layer of cerumen and oil a turf of aspergillus fumigatus was observed.

CASE 27.—M., æt. 53.

January 9, 1884.—Otomycosis dextra. Last two months tickling. Three months ago instillation of oil, a simultaneous appearance of discharge with an offensive odor. In the removed masses a delicate mycelium, enclosing fat globules arranged like pearls, and also zoöglœa in abundance were found.

January 10th.—Discharge and odor have disappeared from the right ear.

CASE 28.—W. B., æt. 20.

April 26, 1884.—Bilateral residue of otit. med. pur. with persisting perforation after scarlatina five years ago. Bilateral defect of at least two thirds of the drum-membrane. Instillations of oil were made for a long time. The tympanic cavity of the left ear exhibits a whitish lining, which consists under the microscope of a small aspergillus and oil globules. The same is studded with small mould-heads with colorless spores.

CASE 29.—M. A., æt. 30.

September 27, 1884.—Otomycosis dextra. For several years

occasional serous discharge and tickling, which reappeared four weeks ago. For years repeated applications of glycerine and cold cream upon the external meatus as far as the finger could be introduced. The inner part of the cartilaginous and osseous external meatus is filled by a white mass, which can be removed as a whole by the forceps and forms a solid white cast of the external meatus. Only at isolated portions of its surface, brownish dirty small spots are found. The plug consists of epidermis, fat, bacteria, and moulds (moderately thick mycelium with numerous fat globules), round and pear-shaped conidia, and sheaf-formed hyphen bundles ("Graphium" and Verticillium).

CASE 30.—S. G., æt. 59, from the country.

October 12, 1884.—For four weeks pain and hardness of hearing in the right ear, the attending physician orders instillations of oil. Upon the posterior upper quadrant of the drum-membrane and upon the anterior lower osseous wall of the external meatus (here upon brown cerumen and fat), a white gray mould turf of aspergillus fumigatus is situated.

CASE 31.—E. H., æt. 24.

November 15, 1884.—Furuncles in the left external meatus for three weeks. Swelling obstructs the introitus to a chink. Relapses.

November 17th.—A plug of aspergillus niger with fat is removed with a syringe, together with a small croupous exudation. External meatus excoriated and swollen. Patient had three weeks previously instilled oil of almonds.

November 23d.—Additional furuncle.

November 24th.—Last visit to the patient no moulds were found.

CASE 32.—J. F., æt. 55.

Bilateral nervous deafness for six years.

March 16, 1885.—In the left ear a plug, apparently of cerumen, which consisted, when removed the following day, principally of aspergillus flavus and oil. (Patient had the year before used "ear-oil").

April 9th.—External ear normal.

CASE 33.—A. T., merchant, æt. 24.

June 3, 1885.—In the left ear residues with perforation persisting since childhood. Removal of the polypus with the snare two years previously by Prof. Bezold. Defect of entire drum-membrane, dried crusts in innermost portion of external meatus chan-

ging into white masses of epidermis. Tympanic cavity laid bare with glistening promontory.

June 30th.—In the osseous meatus a continuous turf of very small white heads of mould with colorless spores, thin hyphens, and mycelium. Tympanic cavity dry and pale; many yellow masses, consisting partly of pus corpuscles, partly of a large piece of fibrino-sanguinous exudation which is profusely interspersed with pus cells, are removed with the syringe. Copious serous secretion. Iodoform powder until July 7th.

July 8th.—Two croupous shreds of exudation are removed with the syringe, and also on July 9th, 11th, and 13th. Discharge ceases on the 26th.

CASE 34.—F., æt. 82.

Dysacusis.

August 29, 1889.—Otomycosis sinistra; two years ago a feeling of deafness which had disappeared after injections of warm water and has not reappeared since. A few days ago the same feeling, and resonance of his own voice. Patient had formerly quite often and also in the last few weeks instilled "oil of white lilies." In the left ear at the bottom whitish hard masses, which appeared dark-brownish when scraped off with the probe. No discharge. External meatus narrow; somewhat swollen. In the right ear a white-coated mass prevents further inspection. Under the microscope partly epidermis, partly brownish masses of foreign substance are found. In portions of the specimen numerous hyphens and small heads, with a few colorless conidia, of the appearance of aspergillus fumigatus.

October 3d.—Removed the plug. No moulds were found.

CASE 35.—G. S., æt. 12; from the country.

October 5, 1885.—Since his fourth year hardness of hearing. In the right ear for two weeks pain and tickling; discharge for a week. Daily instillations of oil for two weeks by order of attending physician. The bottom of the right external meatus filled by a yellow-gray streaked moist mass of the size of a bean, which consists of a collection of aspergillus niger. The drum-membrane shows a round, bulged, somewhat excoriated place, corresponding to the region of the umbo.

October 6th.—Epidermis upon the drum-membrane almost entirely regenerated; the bulging disappeared; along the handle of the malleus diffuse redness.

CASE 36.—H. S., æt. 29.

January 10, 1886.—Plug at the bottom of right ear. A little

over two weeks ago repeated instillations of oil on account of hardness of hearing. The last few days tickling and some discharge. Dirty yellow at places; orange-red masses filling the bottom of the external meatus were removed with the syringe. The masses consisted of epidermis mycelium and conidia (corresponding to those of aspergillus flavus). A portion of this red but the reddish color is found in places outside of the mycelium in the mass. Drum-membrane shows besides maceration of the epidermis, a formation of the posterior fold. Until January 20th no relapses.

CASE 37.—T., æt. 75.

Formerly under treatment for hardness of hearing with negative result of examination (dysacusis).

February 23, 1886.—In the left meat. oss. a sanguineous cotton pellet plugging the meatus entirely, which was at its innermost portion corresponding to the form of the recessus firmly wedged in and blackish; at that time no microscopical examination.

February 25th.—Some tension around the ear. The bottom partly filled by gray masses. Large membranes with numerous black mould-heads upon very long bearers, which are not septate, contain air-bubbles, and frequently show at the base a short spur-like process, are removed with the syringe. Patient has been advised in summer of 1885 by a physician to place small pieces of lard upon cotton into the bottom of the ear.

CASE 38.—H. D., æt. 38.

August 3, 1886.—Four years ago he was under Prof. Bezold's treatment for mould-formation, and has the habit of meddling a great deal with instruments in his external meatus. He had in childhood a discharge for a long time, as the result of a shot directly at the left ear. At present for a week profuse discharge and tickling in the right ear. Osseous meatus and drum-membrane of the right ear covered with dirty gray-brownish streaked masses. Under the microscope mould mycelium, with numerous small heads of aspergillus fumigatus. The drum-membrane diffusely reddened; isolated small places surrounded by round white areas of epidermis, resembling small burst bubbles. Left ear: posterior lower quadrant occupied by a cicatrix.

August 8th.—No formation of mould visible.

CASE 39.—Miss B., æt. 63 (?) (*cp.* history of case). Returned September 16, 1886. She has suffered since from frequently relapsing inflammation of the external ear, with swelling of the cartilaginous meatus. The last months tickling persists, and

"ulcers" are formed. At the bottom of the left ear secretion and dirty cheesy masses are found, which consist for the most part of delicate mycelium, with partly gnarly outgrowths without fructification. Very small, colorless conidia, partly arranged in rows, float in the fluid. Patient denies having lately instilled oil.

Until September 22d, treatment with salicylic acid is continued. No mould elements are found. On the other hand, there are still a discharge and strong fetor. Treatment with boric acid is therefor now substituted (injection of a 4 % solution of boric acid, and, after drying, insufflation of boric acid), whereupon both fetor and discharge disappeared by September 27th.

November 11th.—(Last examination.) External meatus dry and free from inflammation.

CASE 40.—J. R., æt. 19.

Otomycosis dextra. A year ago discharge from the right ear, tinnitus, and hardness of hearing.

November 8, 1886.—The same symptoms, and, as formerly, without pain. At the bottom of the external meatus dirty yellow masses, which contain when removed with the syringe much delicate, partly-disintegrated mycelium, with isolated, distinctly pear-shaped fructifications of verticillium. Instillations of oil had not preceded. On the 20th : external meatus normal.

CASE 41.—G. L.

January 5, 1886.—Hardness of hearing in the left ear for years. Last five weeks, instillations of oil. For four weeks impairment of hearing, tickling in the ear, slight pain, and a discharge. Left drum-membrane covered with dirty yellow masses, which contain under the microscope spores that have fallen off, and of mycelium of verticillium, with indistinct outlines filled partly with fat globules. The drum-membrane appears, after cleansing, dark and diffusely injected.

CASE 42.—V. A.

April 13, 1886—Middle of February swelling at first in the right, two weeks later in the left ear, and hardness of hearing. For four weeks tinnitus, on account of which injections into both ears, and instillations of oil. At present, tickling and tinnitus. From the right meatus a small whitish, from the left a larger gray-yellow, glove-shaped membrane are removed, both consisting exclusively of mycelium and fructfications of aspergillus fumigatus. Slight excoriation of the right external meatus ; drum-membrane covered with a whitish layer.

CASE 43.—H. H., æt. 40.

January 9, 1884.—Bilateral otomycosis. For two years, frequently, discharges and hardness of hearing, alternating in either ear. A year and a half ago, instillations of almond oil. At present, secretion in the right ear, from which mycelium, isolated colorless small spores, and fat globules are removed with the syringe. For two weeks continuous tinnitus. Both drum-membranes dull and lustreless.

January 23d.—Tinnitus still continues, meatuses free.

CASE 44.—Z., æt. 44.

January 18, 1884.—For two years bilateral intermittent discharge, with slight tickling in both ears. Meatuses narrowed by diffuse swelling. Numerous whitish shreds, removed with the syringe. The removed pieces consist of epidermis, and an occasional round-cell, and a few bacilli. Drum-membranes not visible, on account of a collection at the bottom.

January 23d.—Numerous yellow-streaked epidermis lamellæ are removed with the syringe. These contain mycelium, with gnarly outgrowths and isolated small heads of aspergillus fumi-gatus.

February 6th.—Tickling still continues; thick, white epidermis lamellæ are removed with the syringe from both ears, which prove to be free from mould elements. Drum-membrane normal; also on February 15th.

CASE 45.—E. W., æt. 50; from the country.

May 6, 1884.—Damp dwelling-place. For 1½ years hardness of hearing and itching in the ears. For three months frequent instillations of oil. The cartilaginous and osseous parts of the meatuses swollen, at the bottom yellow masses. Gray-yellow, somewhat mucous, odorless masses are removed with the syringe, which masses contain cocci and verticillium elements. The mycelium encloses numerous fat globules.

May 7th.—Extensive formation of epidermis. The masses no longer contain mould elements. Swelling decreased.

May 11th.—Cured.

CASE 46.—K., æt. 29; gardener.

November 18, 1884.—Bilateral otomycosis. For a year frequent bilateral discharge and itching. No instillation of oil. Dirty yellow, extremely fetid, moderately soft mass in the cartilaginous and osseous meatus. Large masses of bacteria in the secretion, besides in the left ear delicate mycelium. On the right ear, at isolated places, numerous conidia of verticillium.

By *November 28th.*—Cured.

January 19th.—Patient presents herself again, with a complaint of reappearance, a few days ago, of itching and discharge. Injections, however, removed epidermis only, without moulds.

January 23, 1885.—Meatuses normal.

CASE 47.—St., æt. 38.

April 4, 1885.—Bilateral otomycosis. For two years bilateral tickling and occasional discharge, slight pain and swelling. In the right meatus there is a deposit on the wall between the cartilaginous and osseous part. It consists of small white conidia, arranged partly like strings of pearls and in groups, and also isolated, dried, small, short, band-like hyphens. Left meatus (not carefully examined) narrowed by quite extensive swelling.

By *April 14th.*—The swelling of the meatus has subsided, and the unbearable itching in the meatuses, which had lasted almost uninterruptedly for two years, has entirely disappeared.

CASE 48.—Z., æt. 33.

July 6, 1885.—Otomycosis of the right ear. For years much tickling. Patient frequently removed odorless masses from the meatus, which had a cheesy, whitish appearance. Oil was never instilled. Patient is troubled with a hypersecretion of sebaceous matter (seborrhœa). Osseous meatus reddened, excoriated, and narrowed by swelling. In the removed masses much gnarly mycelium inclosing fat globules and colorless spores.

By *July 13th.*—Cured.

Patient is a brother of the above-mentioned Miss Z., case 44, but they do not live in the same house. In both the same gnarly mycelium was found.

CASE 49.—Maj. H.

July 24, 1885.—Patient lives in the country. Otit. exter. dex. (bacterial); tickling since last winter. Lately slight pain in the cartilaginous part. At the bottom yellowish masses. Patient has made many injections of water and instillations of oil. The masses consist of epidermis, the film of most delicate fibres (leptothrix ?), and masses of bacilli and cocci.

July 28th.—Cured by treatment with boric acid.

September 22d.—In the left ear for two weeks tickling, for six days discharge, and swelling of meatus; white, on one side brown, lamellæ, containing an immense number of cocci, bacilli, and numerous fructifications of a small aspergillus, are removed with a syringe.

October 5th.—Cured.

The mould was, according to my examinations, a beautiful specimen of aspergillus nidulans ; many old, but no young, fruit-bearers, most of them red-brown, with sterigmata. Conidia free.

CASE 50.—W. V., æt 31 ; from the country.

October 8, 1886.—Bilateral otomycosis. For three years frequently recurring inflammation and discharge of short duration, with tickling, tinnitus, stinging pain, and swelling. Patient had each time made instillations of oil and soap-water. Small pieces of "skin" have frequently been discharged. The removed masses contain nothing but gnarly mould mycelium, without fructifications. Both drum-membranes appear intact.

October 9th.—Meatuses still slightly swollen. No discharge.

CASE 51.—J. E., child (æt. ?).

November 14, 1884.—Deaf-mutism following meningitis, nine months ago. Right drum-membrane cannot be examined, on account of an artificial eczema caused by the instillation of an irritating substance. Left meatus filled by dirty gray membranes, which show, when removed with syringe, a blackish deposit upon one side. This consists of elements of aspergillus fumigatus. Repeated instillations of almond oil had preceded six months ago. The drum-membrane, after cleansing, shows granulations in its lower half.

CASE 52.—J. K., æt. 27 ; miner.

December 8, 1883.—Bilateral hardness of hearing, of varying intensity, for three years. Patient had formerly, and for the past month, instilled ear-oil. Intense tickling in both ears. In the right ear, in the osseous meatus, and on the drum-membrane dry brownish crusts are situated. The drum-membrane, after their removal, appears very white and, together with the handle of the malleus, very diffusely reddened. In the left ear, in the posterior lower quadrant, fresh extravasation of blood. In the osseous meatus no excoriations ; epidermis also thickened, forming regular streaks.

The crusts consisted of numerous fructifications of mucor corymbifer. The specimen is fully described in the following section of this paper.

The following case is appended on account of its great botanical interest, although it did not occur during the period 1881 to 1886.

CASE 53.—F. Z. had been treated in June 1884 by Prof. Bezold for bilateral residues of otitis media after scarlatina. In the right ear extensive double perforation in the anterior and posterior half. Both perforations separated by a narrow scar running from the handle of the malleus downward. In the left ear the lower half occupied by a scar, the upper by calcification in front of and behind the handle of the malleus.

June 19, 1887.—Patient returned on account of a suppuration which had developed in the right ear five days ago, with much pain. A lamella of epidermis with brownish spots and a large croupous membrane were removed with a syringe. In the former a delicate mycelium with colorless fructifications, "similar to those in penicillium." Examination of the right ear: the bridge between the two perforations no longer visible. Bleeding granulation at the margin. Condition of the left ear as in 1884.

The blackish spots consisted, according to my examinations, of fructification of a penicillium. Its full description follows below, (p. 251).

I.—BOTANICAL PART.

a. Exactly determinable were the moulds in 36 patients . . . . . = 69 % of the entire number. The majority of these specimens were still present at the time of my examination.

b. Not determinable were the moulds in 16 patients = 31 % of the entire number. In some of these only mycelium existed, in others conidia and mycelium.

The 36 exactly determined moulds belong to:

c. Asperg. fumigatus Fres. (history of case 1, 6, 11, 12, 13, 14, 16, 21, 25, 26, 30, 34, 38, 42, 44, 51) . . . . . =44.44 % of these, 6 cases (13, 14, 21, 34, 42, 44) were bilateral.

Asperg. niger van Tiegh., 7 cases (7, 8, 10, 18, 31, 35, 37) . . . . . =19.44 %

Asperg. nidulans Eidam, 2 cases (17, 49). = 5.56 %

" flavus Bref., 2 cases (4, 32) . . = 5.56 % of these, 1 case (4) was bilateral.

Verticillium Graphii Harz et Bezold, 7 cases (20 24, 29, 40, 41, 45, 46) . . . = 19.44 %
of these, 4 were bilateral.
Mucor corymbifer Lichth., 1 case (52) bilateral = 2.78 %
" septatus Bezold, 1 case (2) . . = 2.78 %
Not determinable were cases 3, 5, 9, 15, 19, 22, 23, 27, 28, 33, 36, 39, 43, 47, 48, 50, 51; of these, 4 cases were bilateral (3, 9, 43, 50).

In the appended case (53) a very small penicillium was found in the ear during a violent inflammation, which on account of its slender structure and its faculty of growing in the ear—viz. at 98° F.—should be distinguished from penicillium glaucum, and which I would call *penicillium minimum*. The specimen had the following appearance: On the removed membrane blackish spots can be seen at places; when scraped off they appear under the microscope as groups of small rounded conidia which are partly budding and cling to one another by their freshly germinated tubes. When isolated they appear plainly outlined, colorless, and in thick, dark-brown layers (of the color of asperg. niger). The delicate-branched colorless mycelium is septate (diam. = 2μ). The fruit-bearers end neither in solid nor in hollow nodules, but resemble completely those of penicillium glaucum. The total length of the pencil (without conidia) amounts to circa, 20μ; they septate at distances of ca. 6μ. The spherical smooth conidia have a diam. = 2.5—3μ. In addition in each specimen, groups of crumpled, otherwise round, transparent, brownish cells are found, each of ca. 20μ in diam. (Sclerotia, zygospores, or impurities?).

This is the first reliable observation of the pathogenic action of penicillium. That they really grow in the ear, and that the fructifications found were not accidentally introduced, is proved by the subjective and objective symptoms, and also by the fact that between the masses of epidermis in the specimen quite an amount of young and old mycelium and of germinating conidia were found. Prof. Bezold at the first examination had recorded this mould as "penicillium-like."

Another discovery is the occurrence of ***aspergillus nidulans*** in the ear (*cp.* fig. i. plate I.). Both specimens contain a number of the characteristic conidia bearers, which were compared kindly with a pure culture which Prof. Eidam, of Breslau, had sent me. This mould was first described by Eidam in the *Beiträge zur Physiologie der Pflanzen*, by Cohn, vol. iii., No. 3. It was until now of no otological importance, and at any rate unknown to aurists. Eidam found it upon the nest of bumble bees in the botanical garden of Breslau, and cultivated it upon Cohn's nutrient fluid and upon a decoction of manure. It grows best at a temperature of 38°–42° C. (100.4°–107.6° F.) and fructifies at this temperature after 20 to 40 hours. The turf develops in the same manner as in the other aspergilli; the white mildew growing from the centre to the periphery when fructifying takes first a light gray, then a chrome-green, at last a dirty-green color. The fruit-bearers are frequently branched, and then bent; Eidam designates them as dwarfs as compared to the aspergillus niger. Those of the first generation are 0.6 *mm* to 0.8 *mm* long and 8μ to 10μ wide. The receptacle is not round, but appears as a club-shaped, colorless or yellowish, later a brownish end-swelling of the same colored hyphen, being at the most twice as thick as the latter. The top of the receptacle in the ripe fruit is frequently cup-shaped, sometimes as though torn off so as to produce the impression of looking into a funnel from above.

The sterigmata cover only the top of the club. They are less colored than the receptacle, more slender and longer than the sterigmata of the aspergillus fumigatus; they are branched, but show at the utmost two or three small branches. The mass of the sterigmata appear at the head, *on account of their branching* which *as such easily escape detection*, as consisting at places of two concentric layers, of which the inner lower, mostly darker-colored, contains the simple sterigmata, whilst the outer and brighter one contains the lancet-shaped branches. This picture is well known to one familar with asperigillus niger, in which it appears much more beautiful and more distinct. The conidia are spherical, small (3μ), colorless or light brownish,

and when detached from the sterigma firmly cling to one another in chains and chain cords (fig. i., *d* and *e*).

In addition to these conidia-bearers permanent fruits—*perithecia*—are found, with asci containing spores. They are placed like nests in a peculiarly shaped *envelope* into a light-yellowish layer of single-contoured, gnarly, anastomosing hyphens, the numerous end-branchings of which represent round or oval and—with the exception of the place of insertion—double-contoured, very thick-walled receptacles.

The fully developed receptacles have a diam. = 16 to 19μ; the thickness of their wall may amount to 4μ. They appear under the microscope very bright when single, bright yellow in thicker layers. The *fruit-body* proper of the perithecium forms under the magnifying glass a small ball, which can easily be removed from its capsule, and which has in the ripe state from 0.2 *mm* to 0.3 *mm* diam. The asci develop irregularly at an early stage; the wall of the fruit-body becomes, when ripening, dark purple, then black. After ripening the asci also assume this purple color, which finally gathers in the ascospores. (The development of the perithecium is, according to Eidam, very slow, and lasts many weeks until its entire completion.) The asci are ovoid, 10.5 to 11μ in diam., and are found placed on short hyphens associated with one another in all stages of development. The ripe spores, 8 in each ascus, are nearly oval, smooth, with a strong purple-colored external membrane; diam. = 5 1.4μ. Germination takes place as in the spores of Eurotium repens and glaucus, during which their purple color changes to violet. It is noteworthy that the first rudiments of the fruit-body turn blue with a potash solution, and red with acetic acid. Intravenous injection of the conidia has a pathogenic effect.

Three years later a paper on the same subject was published by Lindt (Communications on Some Path. Moulds, *Arch. of experim. Pathol. u Pharmakologie*, 1886). Lindt cultivates the aspergillus nidulans upon 1 % bread agar in the incubator at 98° F. His description agrees, on the whole, with that of Eidam.

I have very little to add to the above description. In the

masses removed from the ear of H. (case 49), almost half of all the receptacles were entirely denuded. Sterigmata and conidia are, for the greater part, frequently still in situ, somewhat swollen, and thus not very distinct. The riper conidia are in thick layers, yellow, dirty-green-brownish, or light-brown. The bright-arched zone, which in aspergillus niger is well marked between the sterigmata of the first and second order, is found only in young specimens, and then only after long search. The sterigmata are too light-colored to make the colorless septa appear well marked.

Aspergillus nidulans is distinguished from aspergillus fumigatus, not only by the sterigmata which in the ripe are brighter and much longer, but also by the loose attachment of the latter in this stage. The darkest receptacles therefore have frequently a naked vertex, whilst in fumigatus it is usually covered by a densely bristled cap. Furthermore, the receptacles and fruit-bearers of nidulans have a brownish, those of fumigatus a smoke-gray color. In the specimen taken from the ear the fruit-bearers had an exquisite reddish-brown, which color was also found in pure cultures upon sterilized bovine serum. Whilst I can confirm the botanical communications of Eidam and Lindt, I would like to add that according to my examinations and cultivations the spores arising from the perithecia are neither oval nor round, but that they have the lentil shape of the Eurotium spores, and that they have like these a rather deep circular furrow at their sharp margin corresponding to their largest circumference. They appear therefore when viewed from the surface entirely circular; but when viewed from the margin they offer the picture of a spindle, both of whose poles are somewhat indented.

I dwell upon the latter picture somewhat longer because I believe that the perithecium of aspergillus nidulans has been found before in the ear, and that it is identical with the obscure otomyces purpureus Wreden et S. M. Burnett. These authors describe in their respective cases (*Archiv f. Ohrenheilk.*, vol. iii., No. 2, and these ARCHIVES, vol. x., p. 318) the following structure: Masses resembling blood-clots, which formed during acute inflammatory symptoms, and consist of

delicate (diam. = 5.7 to 7.0μ) branched and septate double-contoured mycelium. The latter bears round, thick-walled receptacles, "sporangia" (Wreden), or "asci" (Burnett), of 21 to 64μ in diam. These are pale-yellowish, and without contents, or purple-red and with spores. The free ripe spores are larger than the enclosed spores, with frequently divided, nuclear structures, round purple-red; diam. = 2.9 to 4.3μ, and when germinating 7 to 8.5μ. The red coloring matter was exclusively confined to the asci, but appeared scattered in the older portions throughout the entire mass. Even the epithelial cells were beautifully and equally colored by it. Wreden subsequently saw an aspergillus grow from this mass, with dark small heads, which he thinks is asperillus niger, and therefore considers otomyces purpureus as the permanent fruit of aspergillus niger, in which view he is supported by the botanist Waronin, of St. Petersburg. Prof. Farlow, of Harvard University, on the other hand, justly denies the identity of Burnett's mould with aspergillus niger, and decides that otomyces is an entirely new or an, up to that time, incompletely described Eurotium, which view is accepted by Burnett.

As can easily be seen, Wreden-Burnett's description on the one hand, and Eidam-Lindt's on the other, do not agree in all their details. But the difference is so slight and the description is on the whole so similar as to make me willingly change my former attempt at explaining this description (*cp.* "Die Fadenpilze," etc., Wiesbaden, 1883, p. 53) for the above more intelligible explanation. It is more doubtful whether the aspergillus nidulans is identical with the mould which Gruber found in the ear (*Monatsschr. f. Ohrenheilk.*, September, 1870), and which was described by Prof. Karsten as being very small, half as large as aspergillus fumigatus, with club-shaped receptacles, and awl-like, upward-turned sterigmata. Dr. Orne Green described an aspergillus rubens at a meeting of the Boston Society of Medical Sciences (November 19, 1868). I regret that I did not succeed in gaining access to a full description of it. The pathogenic property of the aspergillus nidulans discovered in 1883 is, according to the above communication, really of

practical importance. That this aspergillus is comparatively not infrequent, and that after careful search and right judgment of the characteristics distinguishing it from fumigatus, it will certainly in future be still more frequent, is proven by the fact that among the above-described cases it reaches the percentage of aspergillus flavus, viz., 5.56 %.

Aspergillus flavus played a much more important part in former reports on otomycosis than now. Wreden ("Die Myringomykosis aspergillina in den Jahren, 1869–1873"; *Archiv f. Augen- und Ohrenheilk.*, iv., p. 87) reports that among seventy-four cases of otomycosis aspergill. he has seen the aspergillus "flavescens" twenty-four times (*i. e.*, in almost 33 % of all cases). Prof. Bezold ("Ueber Otomycosis," lecture delivered before the Ærztliche Verein of Munich, 1880) found among forty determinable moulds taken from the ear "flavescens" only eight times (*i. e.*, 20 % of the cases). C. H. Burnett, however, reports in 1879 (twenty cases of aspergillus, *Amer. Journ. of Otol.*, 1879, vol. i.) that he did not find the "flavescens" in one of his patients suffering from otomycosis.

The frequency of *aspergillus niger* shows a similar relation. This can probably be accounted for by the fact that the small forms of moulds give on the whole less cause for an examination of masses removed from the ear in which moulds are suspected. Wreden found the asperg. "nigricans" in *ca.* 66 %, Burnett even in 100 % of all their cases of otomycosis. Bezold recorded, in 1888, 11 cases of niger (among 40). Our record of 19.44 % does not materially differ from these two figures; there is, at any rate, a slight decrease to be noticed.

Prof. Bezold first called the attention of aurists to the occurrence and to the comparative frequency of *asperg. fumigatus* in the ear. In his statistics of 1880 he states a frequency of 18 : 40 = 45 %, a proportion which almost entirely agrees with that of our synopsis, in which fumigatus figures with 44 %.

Before I enter into the discussion of other moulds, I should like to speak first of the present nomenclature of aspergilli. Flavescens and nigricans of Wreden have been

recognized as independent species, and as identical with asperg. flavus Bref. and with niger van Tiegh. respectively, according to my culture experiment with asperg. niger taken from the ear, comparison of measures recorded by the authors, and also according to comparison of the specimens of flavescens and nigricans found in otomycosis with the specimen of Rabenhorst's mould collection. It would therefore be desirable that the former denotations be entirely given up by physicians. The aspergilli niger and flavus are found as such embodied in Rabenhorst's mould collection; they are described as such in Winter's standard work, and no expert botanist recognizes, in addition to these, a special aspergillus flavescens or nigricans. It will be better to call them aspergillus niger van Tieghem and aspergillus flavus Brefeld. The names A. nigricans, nigrescens, and flavescens have no title in scientific botany.

With the large percentage, 19.44 (the same as that of A. niger), we furthermore find in our statistical synopsis a verticillium recorded. Profs. Harz and Bezold thus call a mould which—not identical with any botanically known mould—was first described as a rarity by Hassenstein and Hallier, and a year later by Steudener, and which was also found three times in the ear by Prof. Bezold as early as 1870 to 1879. Prof. Hassenstein, in the *Archiv f. Ohrenheilk.*, vol. iv., p. 162, under the heading, "Beobachtung eines neuen Pilzes, des Graphium penicilloides im äusseren Gehörgange, von Medicinalrath Dr. Hassenstein in Gotha, mit Nachtrag von Prof. Dr. Hallier in Jena," gives an extensive history of a case.

F. Steudener (Zwei neue Ohrpilze, *Archiv f. Ohrenheilk.*, vol. v., 1870) describes a mould found by Prof. Schwartze in the ear, which there had produced symptoms; "these were entirely identical with those already known as arising from aspergillus growths in the ear."

Hallier's stemphylium, Steudener's trichothecium, and also Harz-Bezold's verticillium are apparently identical. This view is supported by such descriptions as exist, by the illustrations, and by the specimens. But concerning the graphium? In no single case of otomycosis have several

forms of moulds been simultaneously found alongside of one another. And still these stem-like structures have not only been found once, but regularly associated in all the specimens of Prof. Bezold, which he formerly considered, with Steudener, as trichothecium, later (according to Prof. Harz' statement) as a mixture of graphium and verticillium. For a long time, however, he believed these moulds to be identical just on account of this occurrence.

I had the finest of these specimens drawn; it is taken from the patient, M. A. (Case 29, *cp.* fig. ii., plate I.).

Under the cover-glass there are six small flakes, each of which consists exclusively of a light-yellow mould-mass. On the margin are the delicate, almost colorless fruit-bearers; in the centre of the flake is the mycelium, which is about 3μ thick, double-contoured and septate, slender, branched, and partly containing fat; in addition there are brown older elements. Oval spores are irregularly scattered over the field of vision; the bright ones hang on the fruit-bearers; large, darker, double-contoured ones, which have fallen off, are principally found in the centre of the mould-flake.

The fruit-bearers (fig. ii., *b*) are mostly colorless or light-yellow, with delicate walls, and exhibit the character of a straight stem. From this, at short distances, and at an upward acute, or at about right angles, longer simple or branched twigs are given off, which stand at places in pairs and opposite to one another, more frequently alternating or entirely irregular. Each twig-end bears as a prolongation a spore. In the *stem formation* (fig. ii., *a*) we find longitudinally fibred bundles, measuring from 3μ to 0.3 *mm*, which, at their upper free end, divide like a broom. Their single fibres are not distinctly septate, but in their other respects correspond to the mycelium of the verticillium.

It is characteristic of the biology of verticillium that of seven cases of otomycosis with fetid discharge, we had to deal with verticillium four times. More than half of all the seven cases of verticillium grew on disintegrated nutrient soil. Still that this is not easily cultivated is demonstrated by a case in which I removed in the winter of 1882–'83 "verticillium and graphium elements." Not knowing them at that time I sent them to Prof. Bezold, whom I consider

an authority on moulds and who was kind enough to determine them botanically. In the meantime I made pure cultures with the fresh material upon granulated sterilized blood-serum and upon 10 % gelatine. The mould did not grow upon the former; upon the latter a white, downy turf with a slightly-yellowish tint developed in the incubator at 37° C. in about four or five days, which showed under the magnifying glass only slight mycelium, but numerous vertical fruit-bearers similar to those of the verticillium taken from the ear, but much stronger and longer. At the periphery macroscopically no lying, creeping, or radiating threads were noticeable, as they are found in all aspergilli, eurotia, and also in most of the mucorineæ under favorable conditions of temperature and nutrition. Under the microscope this growth really proved to be a pure culture of verticillium: strong, pale, very long fruit-bearers with many strong branches, and numerous large and pale spores. "Graphium penic." was not found, although it had been abundantly present in the original specimen.

I regret that I used the entire culture for microscopical specimens before it had assumed a darker color and the conidia had ripened, in the belief that the remaining mycelium might produce new fruit-bearers. At this place, however, no new growth developed, and no case of this kind has since occurred in my practice which offered an opportunity of continuing these pure cultures, of examining the germination of spores, the growth and biology of this mould more carefully, eventually of making some experiments on animals with the spore material. As a probable result of this experiment it appeared to me *that the "graphium"* is not a mould *sui generis*, but *only a stem-formation of the fruit-bearers of verticillium;* this is also found in certain other hyphomycetes as *e.g.*, as a rule, in the Isaria (*cp.* de Bary, "Morphologie und Biologie der Pilze"). Another argument for this view is the fact that the ripe spores of graphium and verticillium are exactly the same; the hyphens themselves have also the same color and dimensions. The third argument for our assertion has been mentioned above, viz., that these two forms of mould are always found

in conjunction in the same ear. Prof. Bezold, in spite of his large relevant material, does not know of any case in which two acknowledged species have been found together in the same ear. There is not even a case known in which in bilateral otomycosis a different species was found in each ear.

Prof. Harz also considers the removed masses and my pure cultures positively as verticillium, and holds that this form does not correspond to any of the known species of this genus. We propose therefore to embody this mould into its proper genus and call it once for all verticillium, with the addition *graphii*, in consideration of its stem-formation having been confounded by its first discoverer, Hallier, with the graphium.

The botanical description is therefore briefly as follows:

Verticillium graphii Harz et Bezold. Stemphylium polymorphum Bon (?) + Graphium penicilloides Corda (?) Hallier. Trichothecium roseum (?) Steudener.

Hyphens of thallus transparent, colorless, later thick-walled, yellow to brown, septate, branched. Diam. = 2 *to* 3 μ. *The fruit-bearers mostly somewhat lighter at larger distance, delicately septate, straighter, and somewhat thinner than the mycelium. Branches in pairs and opposed to one another, frequently given off irregularly, often branched again. Spores isolated at the end of the branches tapering towards the fruit-bearers, when ripe, smoke-gray, ovoid, with smooth surface.* (*Diam.* = 5 : 3 μ.) *Bundle-shaped mycelium-cords and stem-formation, with normal formations of conidia, very frequent.*

The two specimens of *mucor* made me search otological literature for cases of this kind. Tröltsch incidentally mentions in the second edition of his book, in the chapter on otitis externa, an "ascophora elegans" found by him in the ear. Dr. Jul. Böke (*Monatsschr. f. Ohrenheilk.*, 1869, and *Ungar. med. chir. Presse.*, 1868) reports the following history:

A woman, æt. 28, who had never before had an ear disease, gradually became deaf, in November, 1868, without pain, after she had, on account of a laryngeal trouble, made frequent instillations into the ear. White pseudo-membranous mould-masses were removed from the meatus, and again a week later drops of

acetate of lead finally effected a cure. The mould proved to be a mucor ("mucor mucedo") with pear-shaped enlargements of the ends of the hyphens, which contained spores.

More exact description is wanting in this case. Since the spores of mucor mucedo are in reality not pear-shaped but round, Böke's mould is perhaps rather identical with the following mucor corymbifer (Lichtheim).

A Hückel published in 1884 a case of otomycosis mucorina in a dissertation: Contribution to the Study of Mucor Corymbifer (*Beiträge zur pathologischen Anatomie und Physiologie*, by Ziegler and Nauwerk, Jena, 1884).

From the introductory notes of his paper we emphasize the following: Mucor was positively found twice in the lungs of man. In both cases a small form with branched fruit-bearers and smooth sporangium membrane (Fürbringer, *Virchow's Archiv.*, vol. lxvi.) was present. Prof. Lichtheim, of Bern, published in 1883 a careful paper,[1] upon two new kinds of mucor, which is pathologically and botanically extremely interesting. He calls them mucor rhizopodiformis and corymbifer. The latter was found by Hückel in a cerumen plug, which Prof. Wagenhäuser had removed from a patient, 27 years of age, suffering from tinnitus and tickling in both ears, and had left to the former for examination for moulds.

The examination of the patient revealed in both meatuses, between inspissated, dark cerumen, gray-white masses, filling the entire lumen, in which macroscropically vertical threads and dark small heads could be recognized. After removal the walls of the meatus and of the drum-membrane were found loosened and intensely reddened. Treatment—sublimate alcohol. No relapse. The plug, of the size of a pea, contained in a white filter-paper-like mass, dark-brown spots.

The description of mycelium and fructification offers a slightly different feature from the typical picture of m. corymbifer, inasmuch as in this specimen no corymbiate but only dichotomous fruit-hyphens were found, and also large brown, more or less roundish structures, with thick walls,

[1] On Pathogenic Mucorineæ and the Mycosis Produced by Them in Rabbits, *Zeitschr. f. klin. Med.*, vol. vii., 2.

connected with the mycelium, which contained thickly granular protoplasm with a few fat globules, and made the impression of zygospores. Culture and inoculation experiments proved in this case the identity of the mould with the mucor corymbifer Lichtheim.

In the specimen (microscopical only) of case 52 numerous fructifications and a small amount of mycelium of a mucor were found, which was apparently also identical with the above-described one, but at any rate showed *in toto* somewhat smaller dimensions :

The spore-bearers are colorless 3-7μ in thickness, stretched at places with furcate twigs, and aseptate.

The ripe sporangium is club-shaped, yellowish, with transparent, smooth, delicate membrane. Diam., varying, reaching 35μ. In the larger ripe specimens, the top is mostly found, at the equator or lower down, to be irregularly torn off in shreds; at the bottom of the remaining cup-like lower half, spores, but no columella, are visible. Where the columella is visible, it is colorless, transparent, with a convex top. The remaining wall of the sporangium is closely attached to the usually conoid, sometimes hemispherical lower half, which gradually passes into the bearer. In addition, isolated dwarf sporangia are present. The spores are *in toto* oval, diam. = 2-3μ, colorless, in thickened layers slightly yellowish. Where they were exposed to glycerine(preserving fluid) they were somewhat shrunken and appeared angular. The greatest part of the mould-mass is entirely enclosed by brown oil and therefore the course of the mycelium and the sporangium-bearers cannot be distinctly made out. Furthermore, this fluid might have somewhat changed the usually darker color of the contents of the sporangium.

I enter now into the description of another noteworthy, vigorous mucorinea, found among our cases, which, when magnified 100 times, can easily be recognized in all its details, and which was found in case 2 in large masses.

Mucor Septatus Bezold.

The *mycelium* is colorless, little or not at all septate, at places with spindle-like swellings. The ripe sporangium-

bearers have a diam. = *Ca*, 10μ, a light- to chocolate-brown color, thick walls, which show some dark, gland-shaped or oval, slightly thickened spots, apparently towards the lumen of the bearer. The branches are mostly in clusters; less frequently at the top a corymb of three to four short sporangium-bearing twigs is found. Lower down the main stem, usually where several branches are given off close to one another, appears to be abruptly swollen like a club, and of a darker color, with the above-mentioned gland-shaped spots, and with root-like or warty, colorless or brown bulgings of the wall. Spur-like processes are found as an exception farther up at the fruit-bearers. The sporangium-bearers are septate; strong septa are rarely missing, especially near the branchings and the sporangium. The bearer widens above, towards the insertion of the sporangium. The *sporangium* itself is of a pale, brownish-yellow color, spherical, with transparent membrane, and smooth or slightly mulberry-like surface. Diam. = 32μ. The spores fill the entire space down to the apophysis between sporangiola (sporangium-membrane) and between the at first small, light, colorless columella, and cover the latter from above and from the sides, in such a way as to make it only visible from below. There are comparatively very few sporangia still preserved. Most of them have been probably destroyed by the injections of water into the ear.[1] The columella apparently develops further after the loss of sporangiola and spores, then appears brownish, of the color of the sporangium-bearers, slightly oval or spherical, not tapering towards the base. The lower pole is somewhat flattened, so as to make the walls of the columella and sporangium-bearer pass into one another, with sharply defined, at places even rectangular bending. At this junction the remnant of the torn-off sporangium-membrane is frequently found as a very small circular ruff. Diam. = 27μ. A number of the older columellæ are crumpled, torn in shreds, with a top flattened out, whereby the columella appears like an umbrella, a mushroom, or a head of a nail

[1] In a large number of the known species of mucor, the sporangiola (enveloping membrane) bursts when water is poured upon it, and dissolves, so as to set free the spores and columella.

(fig. 3, *d* and *e*). The spores are light-yellow or slightly brownish, smooth, spherical, or slightly oval. Diam. = 2.5 –4μ.

This mucor is not identical with any of the known species. It bears a striking resemblance to rhizopodiformis Lichth. : root-like structures, at places spindle-like swelling of the mycelium, round small heads with broad apophyses and round spores. On the other hand, M. rhizopodiformis has black sporangia, columellæ like an inverted jar, aseptate, and sporangium-bearers, mostly without branches, and considerably larger spores. The latter condition holds good also of M. stolonifer, the spores of which have a diam. of 10–20μ. M. pusillus Lindt has, like rhizopodiformis, columellæ, slightly tapering towards the apophysis. The membrane of the ripe sporangia is thistly, the fruits are placed upon a single bearer, or at the utmost upon one fork, with equally long branches.

Rhizopus Link has very large (11 : 15μ) and markedly oval spores and vesicles of 112–180μ. Mucor ramosus Lindt and corymbifer Lichth. have pear-shaped sporangia, and are therefore left entirely out of consideration. The absence of the septa in M. rhizopodiformis, which botanically is nearest to our mould, called forth the denotation of M. septatus. Our mould shows in all parts such typical, vigorous forms that it can hardly be considered as a stunted variety of another species. Culture experiments, which are the only proof, are wanting. We shall call the mould mucor septatus, until its pathogeneity has been demonstrated.

It is known that the moulds assume atypical forms under unfavorable nutritive conditions, and remain small, producing only mycelium, without fructifications. We frequently find a very young growth which has not as yet fructified. It is therefore all the more desirable to make in each doubtful case *culture experiments* for the determination of the identity of the vegetable parasites. For this purpose, a part of this mould-mass should be rapidly dried, at a temperature of *ca.* 30° to 50° C., preserved in a dry state in a sterilized test-tube, and the other half placed in a preserving fluid.

The culture experiment can be simply made in the following manner: First, heat needle and forceps to a glow, clean the hands with carbolized water, and soap the glass plate, stool, and bell in the well-known manner in sublimate water, subsequently pour over alcohol and ether, cover the bottom of the plate with filter paper which is imbued with well boiled water; then place upon the stool, which rests upon the filter paper, a roll freshly baked, rapidly washed in sublimate water, and divided with a sterilized knife. Upon the cut surfaces of the roll which look upward, we rub energetically and extensively the masses taken from the ear, cover them well with bell or plate, and place this apparatus in winter-time near the oven, wrapping it up at night in flannel to prevent cooling of the culture. After one to two days we moisten the bread once more with well-boiled water and keep the filter-paper cover moist. Still simpler is the culture upon a thick bread-pap (bread-decoction) in Erlenmeyer's flask.

If we have all the apparatus, we may sow another part of the mass taken from the ear upon sterilized, slightly acid, 10 to 15 % solution of gelatine, or upon bread-decoction-agar, spread it well with a platinum loop brought to a glow over the sterilized plate or flask, and then bring it as it is described above under the moist bell-jar, which should be kept warm. Malignant moulds develop as early as in 36 to 48 hours and at lower temperatures in about twice that time, so as to enable us to distinguish them macroscopically or with the magnifying glass. At any rate the microscopic examination should not be neglected, for which a magnifying power of from 200 to 300 should be used.[1]

II.—CLINICAL PART.

Occurrence and Etiology.—In my former synopsis (*cp.* Fadenpilze, 1883) of Burnett's, Wreden's and Burckhardt's cases, $\frac{1}{4}$ occurred in the first half of the year and $\frac{3}{4}$ in the second. This peculiar disproportion is not found in this

[1] The author will be very much indebted to those of his colleagues who send masses in which moulds are suspected and which have been taken from the ear, and he will be very glad to furnish them with information upon the result of the examinations.

synopsis, since the 52 cases are almost equally distributed over both halves of the year. Most of the cases were treated in January and September. The *season*, therefore, appears to have no influence whatever upon the occurrence of otomycosis. Among the patients

2	were	from	1–15	years	of	age
3	"	"	16–20	"	"	"
12	"	"	21–30	"	"	"
15	"	"	31–40	"	"	"
5	"	"	41–50	"	"	"
9	"	"	51–60	"	"	"
3	"	"	61–70	"	"	"
2	"	"	71–80	"	"	"
1	"	"	81–90	"	"	"

The observation, first made by Wreden, of the rare occurrence of otomycosis among children until the fifteenth year of age, is thus confirmed. In this synopsis adults from 16 to 20 years do not frequently suffer from otomycosis. It is a remarkable fact that among our 52 cases, country-people and gardeners are frequently affected. They comprise of 15 cases, 29 %, whilst hardly more than 10 % of all ear patients treated during the same period belong to this class. The statistics prove the contrary of the assertion of others, that the country population suffer more from otomycosis on account of their being exposed to direct sun radiation, to heat and perspiration.

There is a great discrepancy of opinion between authors as regards the *frequency of otomycosis in general.* Whilst Bezold stated, as late as 1880 (*cp.* lecture delivered before the Medical Society of Munich), that of 65 patients 1 had otomycosis, we find in the entire number of 8,272 patients treated from 1881–1886 only 52 cases of otomycosis = 1 : 159 = 0.65 % (*i. e.*, from 1881–1883 = 0.7 %; from 1884–1886 = 0.6 %). During the years 1872–1880 there was 1 %.

It is improbable that, as can be seen from this large statistical material, the difference of the figures and the gradual decrease of the frequency of otomycosis is purely accidental. This depends, probably, upon the less frequent application

of oil instillations, against which aurists have warned lately. Their dependence upon local causes is also proved by the fact that in two years six cases of otomycosis came under my treatment in the mountain village of Klosters though it had but a very small population. This is a remarkably high figure, since it comprises at any rate 5 % of all ear patients treated during that period.

The other authors report a small percentage of frequency. According to Bürkner (Contribution to the Statistics of Ear Diseases, *Arch. f. Ohrenheilk.*, vol. xx., p. 2), the percentage of otomycosis among all ear-patients is as follows: Bezold 1 %, Hedinger 0.5 %, Roosa 0.4 %, Burckhardt-Merian 0.3 %, Marian, 0.3 %, Schwartze 0.16 %, Bürkner, Knapp, Gruber, and Shaw-Blake 0.1 %, Lucae 0.09 %, De Rossi, Schalle, and Tröltsch 0.0 %. The average figure is, according to Bürkner, 0.1 %. We shall not lay much stress upon these figures; for those aurists who consider the parasitory invasion as accidental will with less care hunt for hyphomycetes, a fact which will be demonstrated by their statistics.

It would also be desirable to report the cases of private practice separately from those of the dispensary, since the frequency of otomycosis greatly differs in the two. In the "Statistische Uebersicht der Berliner Universitäts-Policlinic für Ohrenkranke" (*Arch. f. Ohrenheilk.*, vol. xiv., p. 126) Lucae states that according to his experience of 10 years the otomycosis is chiefly a disease of well-to-do people, occurring more frequently in private practice. Knapp, who holds a similar opinion (these ARCHIVES, vol. xi. p. 205), had among 866 private patients 11—*i. e.*, 1.4 % cases of otomycosis, and Prof. Moos had verbally made about the same statement. Bezold's figures in his statistical reports from 1881–1883 and from 1884–1886 (*Arch. f. Ohrenheilk.*, vols. xxi. and xxv.[1]) agree with these facts, since we find in *private* practice the proportion of 14 : 5,707 = 1 : 121 = 0.82 %, and in *dispensary* practice 5 : 2,565 = 1 : 515 = 0.2 %.

[1] We found there, to be true, 54 cases recorded as the entire number of otomycosis patients, whilst we report here only 52 cases. This diminution is due to an exclusion of two cases, after careful revision, because their mould elements could not with certainty be attributed to the hyphomycetes, but they showed a rather yeast-like form.

The frequency among patients treated in private practice is thus four times greater than among the dispensary patients. This remarkable disproportion may depend upon the easy access to medical treatment for dispensary patients, who mostly apply without previous medication, whilst the well-to-do population of cities, and still more that of the country, first make different and improper attempts at curing their troubles themselves, which are followed by otomycosis—*i. e.*, as a secondary affection.

Until the appearance of the mycosis 8 patients = 14 % probably had no trouble; 44 patients = 86 % had had other ear affections before otomycosis. These previous affections were confined to the outer ear in 14 cases = 32 %; to the middle ear also in 14 cases = 32 %; and to the inner ear in 16 cases = 36 %. Among the diseases of the outer ear we emphasize 1 case of furunculosis, 2 cases of otitis externa, and 9 cases of frequently relapsing inflammation of the external ear—similar to the last-mentioned disease, in which mycosis was then proved.

Among the 14 cases of the middle ear were 9 cases of perforation of the drum-membrane (3 of these with a slight otorrhœa nearing its resolution, the other six dry).

Diseases of the inner ear were 12 cases of hardness of hearing from unknown causes, and 4 cases of nervous hardness of hearing and complete deafness.

The large percentage of patients suffering from affections of the inner ear is noteworthy; among all ear-patients treated by Bezold during the years 1881 to 1886, only 10 % had diseases of the inner ear.

Previous instillation of oil or glycerine, or introduction of fatty materials, was proved in 39 patients = 75 %. Patients suffering from nervous hardness of hearing and deafness, generally those suffering from affections of the inner ear, made by far the most frequent instillations (11 of 12 patients = 92 %). Hence it follows that otomycosis is most frequent in diseases of those parts which are farthest from the external ear, and which give therapeutically the least satisfaction, and are therefore most frequently treated by the patients themselves.

It is not quite clear in what manner the oil fosters the development of otomycosis. It is not well suited for nutrition of the mould, but it has the quality of preventing, when used in a small amount—*i. e.*, as a very thin covering layer —in cultures upon solidified serum, the fructifications of air mycelium in favor of a more vigorous thallus growth. Furthermore, we should remember that, according to Raulin's experiments (*Annales des sc. nat.*, ser. v., vol. xi.) aspergillus niger does not develop a strong ferment effect before the exclusion of air, and that further in acute eczemata and in erythemata application of fat frequently increases the inflammation, and at any rate counteracts the drying up of the secretion.

Symptomatology.—Eight cases = 15 %, two with asperg. fumigatus, two with asperg. flavus, and one with verticillium, were entirely without symptoms. The mould was in these cases located either upon cerumen or a crust. In the cases associated with inflammatory symptoms the most frequently mentioned symptom is: otorrhœa in 30 cases = 58 %, viz., serous discharge in 23 cases; purulent, partly fetid discharge in the 3 verticillium mycoses, cases 20, 24, 46, and 4 other cases—altogether in seven cases. Itching was second in frequency: 25 cases = 49 %. Thirteen patients = 25 % complained of pain; 11 patients = 21 %, of freshly developed or of long-existing impairment of hearing; and 5 patients = 10 %, of subjective noises (humming). Among the objective symptoms I emphasize the following, the seat of the affection was 36 times unilateral, *i. e.*:

on the right ear in 16 cases = 31 %
" left " 20 " = 38 %

Bilaterally affected were 16 patients = 31 %, in which in each case the same mould was found on either side. In 3 cases the moulds were either upon cerumen or enclosed by it, once (case 28) confined to the tympanic cavity only, and in 2 cases (12, 14) located upon the drum-membrane only. In the remaining cases they were found in the osseous meatus, which in five cases they filled so completely that perfect sac-like casts could be removed (cases 12, 14, 18, 21, 42), the form of which represented the osseous meatus and

drum-membrane in all their details (boundary of drum-membrane and wall of the meatus, handle of the malleus, etc.). Two of these cases are illustrated in fig. iv., plate i. In the cartilaginous part and in the auricle mould-masses were never found.

In 40 cases = 38 % the subsequent course was known; it was always favorable. All objective and subjective symptoms disappeared immediately after the introduction of salicyl-alcohol treatment, in most cases after a few days, so that throughout no moulds could be found at the utmost a week after the first examination. Among our 52 cases there is none of an acute development of perforation of the drum-membrane, as in the four cases mentioned by Bezold, in his "Lecture on Otomycosis," and in the case published since by Marian (Report on the Ear-Patients Treated from 1878 to 1880, *Archiv f. Ohrenheilk.*, vol. xvii.). The few cases which took a somewhat abnormal course are as follows: In case 12, a relapse took place after six days; in case 27, itching, and a dirty deposit on the drum-membrane, which was, however, free from moulds, re-appeared after three days; in patient 39 (who had been treated before the beginning of the otomycosis for chronic eczema of the external meatus with frequent exacerbations), the discharge and fetor still continued after six days. In patients Nos. 3 and 4, the primary disease (otitis externa and otitis purulenta chronica respectively) also persisted for one and two months respectively after the cure of the otomycosis. Cases Nos. 10, 31, and 33 suffered a considerable prolongation of the course of the disease, on account of the complication with a very painful otitic crouposa, which in one case (31) appeared simultaneously with the otomycosis, and in cases 10 and 33 immediately succeeded it. A similar otomycosis from Bezold's policlinic, complicated with croup of the external ear, was described by Steinhoff ("Observations on Otitis Externa Crouposa," Dissertation, Munich, 1886). Case 53, the history of which has been appended, and also Burckhardt's case, F. S. (history x. from "Die Fadenpilze Aspergillus," etc., 1883), are relevant. As a further complication, furunculosis (in case 10) was

found in the course of otomycosis. A relapse, as was mentioned above, was seen only once. The later, *i. e.*, the reappearance after months or years of the same disease in the same individual, is, of course, not excluded. Three patients = 6 % (case 39 after five years, case 38 after four years, case 13 after 3 years) were thus, as has been proved, affected for the second time with otomycosis.

I regret to say that I could not learn from the history of the cases, whether we had to deal with the same species of mould in the first and second attacks.

The treatment consisted, as has been mentioned in history No. 1, in ear-baths of 2 % salicyl-alcohol, to be applied three times a day for ten minutes, and in daily injections of solutions of boric acid. In case 7 powdered boric acid only, in case 9 a mixture of boric acid and iodoform āā was prescribed, in both cases successfully.[1]

The histories of the above-reported 52 patients and their statistical evaluation confirm in general the result of other new contributions to this subject. But in some respects they furnish valuable additions to our knowledge. In conclusion I give a brief résumé of the most important results:

A new case of otomycosis mucorina corymbifer is communicated (the second reported of this kind).

The occurrence of a small penicillium of the peculiar mucor septatus, which has never before been described; and, also, that aspergillus nidulans produces a mycosis in the human ear.

Furthermore, the paper gives an exact description of verticillium graphii, and of its cultivation, and proves its iden-

[1] Walb (Boric Acid as an Antiseptic, *Centralbl. f. klin. Med.*, 1882, No. 34) agrees with Dumas, Gahn, Buchholz, Canné, Neumann, and Polli, that boric acid in a 1 to 2 % solution does not prevent the development of moulds upon Cohn's nutritive fluid or meat extract. He thinks, therefore, that he is justified in the belief that the otomycosis will resist the application of boric acid. My culture experiments with asperg. niger upon egg-albumen containing boric acid, and also the experience derived from Burckhardt's case 10 (*cp.* Die Fadenpilze Aspergillus), are in accordance with this fact. If we add larger quantities of boric acid—"exceeding the serum in amount,"—it invariably became, according to my experience (*ibid.*), sterile; neither could I cultivate an aspergillus niger upon gelatine saturated with boric acid. We find indeed in literature also favorable reports on the results of treatment with insufflations of boric acid, as, for instance, by Marian (Report on Ear-Patients Treated from 1878 to 1880, *Archiv f. Ohrenheilk.*, vol. xvii.), and by Samuel Theobald (Four Cases of Otomycosis, *Amer. Jour. Otol.*, vol. iii., 2).

tity with the moulds which have been found in the ear before, but have been erroneously identified with "trichothecium," or stemphylium and graphium.

A review of the botanical results reveals an unusual frequency of the occurrence of the single species of moulds in the ear.

Furthermore, a decrease in the frequency of otomycosis during the last years is proven.

We are enabled to confirm the view first proven by Bezold's experience, that instillations of oil into the ear play such an important part in the production of disease as to warrant their special consideration in treatment and prophylaxis.

Occupation as such, residence, and season have apparently no special influence upon the occurrence and development of otomycosis. This affection, however, is more frequent among dwellers in the country than in the city, and more frequent in private practice than among the poorer classes.

With regard to the symptomatology, the material does not offer any new facts. Among the complications otitis crouposa is noteworthy on account of its rare occurrence.

Treatment with 2 % salicyl-alcohol apparently offers sufficient guaranty against relapses.

At the conclusion I express to Prof. Bezold my sincerest thanks, and also to Prof. Bollinger, who generously placed the laboratory of the Pathological Institute of Munich at my disposal.

Explanation of the Illustrations.

FIG. I—Aspergillus nidulans.

a. Older fruit-head with indistinct structure of the sterigmata. Conidia mostly fallen off.

b. Fruit-receptacle with cup-shaped top.

c. Younger fruit-head. The fallen off conidia are lying close by as a mass consisting mostly of parallel chains.

d. Older conidia, partly in chains.

FIG. II.—Verticillium graphii.

a. Stem-formation.

b. Normal fruit-bearer, young growth.

c. Older spores, fallen off.

d. Older mycelium.

FIG. III.—Mucor septatus.

a. Rhizoid formation.

b. Columella, naked (after bursting of sporangiola).

c. Sporangium.

d. Fruit-bearers with burst sporangia.

e. Torn and compressed columellæ.

FIG. IV.—Casts of the osseous meatus consisting of mould-masses.

a. Solid (with verticillium graphii).

b. Hollow, like a cul-de-sac, (with aspergillus fumigatus).

A RARE CASE OF AUDITORY REFLEXES.

By H. STEINBRÜGGE, Giessen.

Translated by J. B. McMahon, New York.

I AM indebted to Prof. Riegel for the opportunity to communicate the following case of hysteria in a male, which, apart from its general clinical interest, may also have some importance in its acoustic and physiological bearings. I am also very much indebted to Dr. A. Hoffmann, assistant to the medical clinic, for his friendly aid in the examination of the patient.

The patient is a countryman, 45 years of age. Fifteen years ago he was suddenly attacked with peculiar convulsive movements, as the result of a severe fright. Since then these attacks have occurred repeatedly under the influence of certain exciting causes. The patient is of medium size, powerfully built, has pale skin and mucous membranes, a poor carriage, and the expression of a sick man. He is afflicted with an umbilical hernia and with inguinal herniæ on both sides. The examination of the chest and abdomen reveals nothing abnormal. The tongue is coated somewhat. Pulse 52. Cardiac sounds weak but pure. The convulsive attacks occur regularly whenever the patient hears instrumental music of any kind. The sound of a child's trumpet was always sufficient to provoke one. Ordinary noises produced, however, no such effect; so with the sound of drums, the tumult of the street, and of railroads. Patient stated that tobacco smoke, and other like influences which tended to cause nausea, as also pressure over the region of the stomach, had occasionally given rise to the attacks, but that it was mainly musical impressions to which they were due.

The course of the attacks was as follows: They began with a

cold sensation which rose from the knees to the stomach, or with a general rigor, then after a few long breaths the respiration became shorter and more rapid, even to the surprising rate of 60 in a quarter minute. Respiration then ceased entirely for a short time, and following this came irregular breathing, occasional yawns, and deep, heavy inspirations. The same chain of phenomena was repeated after a while, with diminished severity and duration; rapid respiration, apnœa, irregular breathing, and this continued till the end of the attack, after some 5 or 10 minutes. The patient meanwhile was conscious, heard well, executed motions as suggested to him, but could not speak. The pupils were normal in size and light reaction. Immediately after the attack patient could only stammer, but he shortly recovered full power of speech. After the attacks he always felt much exhausted, and was very thirsty; he sometimes vomited, and occasionally had severe spasmodic cough and rigors.

It seemed to be essentially a case of respiratory spasm due to reflex irritation of the respiratory centre in the medulla through the auditory nerve. The acoustic irritation seemed also to exert a reflex irritation in the region of the hypoglossal nerve. *While it was of special interest that the reflex phenomena were produced mainly through the auditory nerves, it is still more striking that the spasms could be provoked by musical tones only and not by noises.* Dr. Hoffmann and I convinced ourselves of this as follows: A tuning-fork (a′) placed on the forehead caused an incipient attack, which ceased on rapidly removing the fork; yet the rattling noise of the spring of an induction-apparatus was borne without discomfort, though at the same time a faradic stream was passing through the body of the patient, producing powerful contractions of the muscles of the forearm.

An examination of the ear gave the following results:

Patient had had an otorrhœa in his youth, but he could not remember in which ear. Hearing for watch R $\frac{9-15}{10}$ metre; L neither by bone- nor air-conduction. The right drum-membrane showed opaque bands in the anterior half, and a large cicatrix posteriorly, which was partly concealed by a hyperostosis of the posterior and upper part of the external canal. In the left meatus was a hard plug, composed of a mass of epithelium and dried secretions; it could only be removed after softening with a solution

of carbonate of soda. The left auditory canal was also narrowed by a projection of the lower wall; the drum-membrane, visible only in its upper half, was thickened and lustreless. The ears had plainly been the seat of chronic inflammatory processes, probably otorrhœa, which had left the conditions described above, and had caused the diminution of the hearing; the possibility could not, however, be excluded, that at some previous time there had been irritation of the end-organs of the auditory nerve, or of the centripetal conduction paths. At the time of this examination, a hyperæsthesia of the auditory nerves was not discovered by the use of the galvanic current; with a current passing obliquely through the head a short noise was heard in the left ear on cathode closure, but not till its strength had been brought up to 8 M. A. Further subjective noises were not complained of.

On removal of the plug which had closed the left ear, the watch was heard on contact; by bone-conduction uncertain. Whisper was heard, right, at 2 metres; left, close to ear. The tuning-fork (a') was heard from forehead equally well in both ears. Rinné's test proved positive on the right side, negative on the left. On using Politzer's method of inflation, the air passed readily into both tympana; on the right side the hearing for the watch was improved to $^{0}/_{10}^{2}$ metre.

After a single hypnotization and the suggestion of Dr. Hoffmann that the spasms would not recur in the future, the attacks, which had lasted 15 *years, did really cease, and up to the present time have not returned.* The patient is now entirely insensitive to musical impressions; he can even blow on a harmonica without unpleasant consequences.

Several things are to be taken into consideration if we seek the explanation of the cure of the attacks. In the main we had to deal with a functional or so-called hysterical disease of those portions of the cortex which we are accustomed to regard as the seat of the higher psychical activity, especially of the will. Anatomical lesions proper may be positively excluded, since a single suggestion sufficed to rid the patient of his attacks. In consequence of the weak will-force characteristic of hysterical individuals, the power of inhibition which in the healthy prevents the transference of a nervous impulse from one nerve-path to another, was

[1] At this time the patient was already freed from his attacks.

diminished, and lastly there existed a chronic diseased condition of the peripheral organs of hearing, which had probably for some time caused a permanent irritative condition of the auditory nerve-paths, and had left a tendency to nervous disturbances of function. We may regard this as analogous to the epileptic attacks which occur after the healing of injuries of the peripheral nerves, and to which the cicatrices seem to bear a causal relation ; and also to certain forms of disease (which may have already run their course, or which may still be active) of the female sexual organs, of the nasal and pharyngeal mucous membranes, etc. As a rule, some peripheric disease is necessary for the development of diseased reflex processes, but in addition there must be at the same time a functional weakness of the central organs of the nervous system.

We can easily understand how, in the present case, a definite irritation of the auditory within the medulla oblongata could be conveyed to the region of the pneumogastric and hypoglossal, and so cause the peculiar respiratory spasm and the disturbance of speech.

If we may rely on the description given by Schwalbe,[1] the principal nucleus of the auditory nerve, from which the inner portion of the posterior root takes its origin, borders on the pneumogastric nucleus medially, and this latter again medially on the nucleus of the hypoglossal, so that the anatomical conditions are present to justify the above supposition.[2]

When we study further the origin of the spasms, one fact seems here to demand special consideration, namely, the difference in the action of musical tones and of noises. The question of the localization of the perception of tones and noises, we know, has not yet been definitely settled by physiologists. Whilst the majority agree in referring to the

[1] "Lehrbuch der Neurolgie," p. 666.

[2] Freud (*Monatsschrift. f. Ohrenheilkunde*, 1886, No. 8), with Meynert and Clarke, designates the "principal nucleus" of Schwalbe as the "inner nucleus," and expresses himself (*loc. cit.*, p. 248) as follows: "In the gray matter in the floor of the fourth ventricle, laterally situated, is a somewhat elevated nucleus, which in this plane (an oblique section through the medulla) still sends off filaments to the pneumogastric, but later, without change of position, becomes the 'inner auditory nucleus.'" This goes to prove the close relations between the two nuclei.

cochlea the perception of sounds and tones produced by periodical vibrations, it yet remains an open question whether noises (as Exner, Brücke, and, at present, Helmholtz, now hold) cause a vibration of a considerable portion of the basilar membrane, and a simultaneous excitement of a large number of cochlear nerves; the cochlea, therefore, having the perception of such sounds as part of its functions, or if they produce an impression on the end-epithelium of the nervus vestibuli, the macules of the vestibular sac. cules coming into play.

In the case under consideration it is certainly worth noting that the hysterical patient did not develop his spasms under the influence of loud noises, as, for example, a shot, but rather under light sounds and tones, which, as we know, are due to periodic vibrations. If we accept the view that these latter set in vibration a number of the fibres of the zona pectinata, and so excite the filaments of the cochlear nerve connected with these fibres, and if we further attribute the perception of noises to the cochlea, the same fibres and the same cochlear nerves are called into play whenever there are contained in the noises any tones which correspond more or less in their vibrations with those of the fibres. It would then, however, be impossible to understand why the irritation of one and the same nerve fibre should at one time produce, without fail, a spasmodic attack; at another, just as surely not. The objection that an attack can only occur as the result of a long series of periodical irritations, and that the vibration caused by noises is, therefore, too short and transitory, is met by the experiment with the induction-apparatus. The periodic and continued action of the spring was well borne by the patient, because it produced no tone, but only noises in rapid succession.

The case seems to be an argument in favor of the view that the sensations of tone and of noises are conducted to the central organ along different nerve-paths; it also increases the probability of the existence of separate perceptive organs in the labyrinth. This would harmonize much better with the observation of otologists, that changes in the hearing-power for speech and for noises do not bear a definite proportion to each other, than would the physio-

logical hypothesis which refers the perception of noise-impressions to the cochlea.

The anatomical cause of the fibres of the auditory through the ganglion nuclei of the medulla oblongata to the centre in the cortex of the temporal lobe is difficult to follow and involved as yet in some obscurity. We may here note that in addition to the above mentioned principal nucleus, we have to consider the lateral nucleus, from which one part of the anterior root of the nerve takes its origin, while a second part ascends through the corpus restiforme to the cerebellum; this last seems to be connected with the nerves of the ampullæ. The further relations of the cochlear and vestibular nerves to the roots of the auditory are, to my knowledge, as yet unknown. Even the now accepted division (of Retzius), according to which the ramus sacculi and the branch supplying the lower ampulla belong to the cochlear nerve, does not help to explain the further centripetal course of the fibres. The case under discussion would seem to make it probable that the paths for musical tones lead to the principal nucleus, and that those for noises pass along the anterior root of the nerve.

As for the literature on auditory reflexes in those ill of nerve disease, I know of but one work on the subject, by Prof. Högyes, and that only through a review.[1] The author was able in hystero-epileptics to produce, by lightly sounding a tuning-fork, a movement of the eyes toward the source of the sound, and by keeping up the sound for some time to cause violent reflex muscular spasms. He attributed these phenomena to the transference of the irritation from the auditory paths to the nucleus of the abducens, and to the motor ganglion cells of the spinal cord. These were probably cases of complicated spinal diseases. The case now communicated seems worthy of being placed on record, as it presents a rare pathological experiment, which may some time contribute to the explanation of normal physiological processes.[2]

[1] New Contributions to the Physiology and Pathology of Auditory Reflexes, *Orvosi hetilap*, 1885, No. 4. Rev. *Monatsschr. f. Ohrenheilk.*, 1885, No. 3, p. 79.

[2] It may be of interest to the readers of the present article, as well as to its author, to learn that Prof. Erb, last winter, presented a patient before the Heidelberg Medical Society, in whom violent respiratory spasms had been caused by both noises and tones—more so by the higher than by the lower ones.—Moos.

DISEASES OF THE MASTOID PROCESS, WITH A REPORT OF CASES.

By GORHAM BACON, M.D.,
AURAL SURGEON, N. Y. EYE AND EAR INFIRMARY.

(*With four wood-cuts.*)

THAT there are many cases of simple inflammation of the mastoid cells, that would recover spontaneously if left to nature alone, I think no surgeon, who has had a large experience in treating this class of cases, will deny. The great difficulty, however, is in deciding whether we are justified in employing simple antiphlogistic measures alone and allowing the disease to run its course, or whether it is not better surgery to open the mastoid cells, even when we are not certain that they contain pus, in order to err on the safe side and prevent the inflammation from extending inwards towards the brain and giving rise to inflammation and abscess or thrombosis and pyæmia, as is frequently the case. In my experience, the dangers of trephining the mastoid have been very much overestimated, and the more I see of this class of cases, the more inclined I am to operate early. I have never seen any bad results from the operation itself. I would not, however, be understood to treat lightly of the operation of perforating the mastoid, or advise any one without considerable experience in aural practice to undertake this operation. I do, however, believe, that if carefully done and performed under thorough antiseptic precautions, any danger to the patient's life is reduced to a minimum.

In the light of anatomical investigations, we know that no two mastoid processes are exactly alike. According to

Zuckerkandl, who made an examination of one hundred mastoid processes in the fresh state and one hundred and fifty macerated ones, there were absolutely no air cavities in twenty per cent. of the specimens. Of the entire number, thirty-eight and six-tenths per cent. were perfectly pneumatic mastoid processes, without any diploëtic spaces. He also found that in some persons only the upper half of the process was pneumatic, while the lower half was diploëtic. These facts explain, in a way, why in one individual suffering from middle-ear disease, the mastoid cells, where large and pneumatic, may easily be the seat of a severe inflammation from the first. It is probable that in most cases, if not all, of otitis media, the mastoid cells participate in the inflammatory process, and the mastoid process should anatomically be considered a part of the middle ear, as disease of the latter almost always precedes mastoid disease, primary inflammation of the mastoid alone being extremely rare.

In an infant at birth there is usually found but one cell, the antrum and the mastoid process is but a small tuberosity and undeveloped. The antrum in the early months of infancy is covered externally by a very thin wall of bone, which latter is covered by periosteum, and an emissary vein from the mastoid frequently perforates this thin partition of bone. It is easy to understand from these facts why in infants a large swelling frequently appears behind the ear in a very short space of time, even when there may not have been any discharge from the ear at the time, or if present a very slight one. An incision made in these abscesses, so as to allow the escape of pus, is frequently all that is necessary to bring about a cure. At five years of age, the mastoid process of a child is very similar to that of an adult, as regards the position of the antrum and arrangement of the cells, but it is smaller and the bony substance is not as firm and dense as in later life.

Under normal conditions, the mastoid process consists of the antrum, in a position above and behind the tympanum and in direct communication with it, and also of a number of cells, the majority of them probably opening one into the

other. These contain air, and are lined with a continuation of the mucous membrane of the tympanic cavity. Those cells which are not pneumatic usually contain a fatty substance. The upper wall of the antrum is but a thin lamina of bone, which separates it from the dura mater. The lateral sinus is in close proximity to the mastoid cells, and rests against the inner wall of this process. The facial nerve may be involved in any case of mastoid disease, as its course is downwards through the cells, after passing through the upper portion of the tympanic cavity. A very important point in the consideration of mastoid disease is the position and course of several blood-vessels and lymph-vessels with their connective-tissue sheaths, which traverse the antrum and tympanic cavity. (The following cases occurred in my practice:)

CASE I.—Frank T., aged two years, came to the N. Y. Eye and Ear Infirmary February 15, 1887. He had measles a few weeks ago and the right ear has been discharging for a month. An abscess broke behind the ear and this gave relief to the pain.

The right auditory canal is filled with pus. There is considerable swelling of the parts behind the auricle. Fluctuation detected and an incision made with a bistoury, but evacuating very little pus. The probe touches carious bone covering a considerable area, and enters the mastoid antrum. A second point of fluctuation detected above and posterior to the auricle. Very little pus found, but carious bone also discovered here. The sinuses were washed with bichloride-of-mercury solution and dressed with gauze and a bandage applied, rubber drainage-tubes having been previously introduced.

February 18th.—Wounds dressed and looking well. The patient given ℞. Syr. ferri iod., gtt. xv. three times daily.

March 18th.—The patient etherized and both sinuses laid open by an incision made behind the auricle three inches in length. The bone was found bare and a director passed easily into the antrum, which contained pus. The ear was syringed out with a solution of carbolic acid (1–40) and the stream passed readily through the lower sinus behind the auricle. Considerable broken-down tissue was removed with a curette. The antrum and sinus together with the auditory meatus were then packed with carbolic gauze and a bandage was applied.

22d.—The dressings removed. The ear and sinuses were irrigated with bichloride-of-mercury solution (1–1000). There was considerable discharge on the dressings.

April 8th.—The exuberant granulations about the sinus have been cauterized with nitrate of silver and the ear has been dressed frequently with the bichloride solution, and to-day iodoform has been used. The boy was also given potas. iod., gr. i. three times daily, besides the syr. ferri iodid.

January 15, 1889.—The boy has been under observation at times ever since. Last summer, a sequestrum of bone came away from the opening behind the auricle, measuring $\frac{3}{4}'' \times \frac{3}{4}''$. This had been loose for some time. There is at present no discharge from the meatus. The membrana tympani can be seen through the opening behind the auricle, which is now one quarter of an inch in diameter. The lower and posterior half of the drumhead is destroyed, and the malleus adherent to the inner wall of the tympanum.

There was at one time some discharge from the left ear, but an examination to-day showed that the membrana tympani had healed. The boy seems to hear well.

Case 2.—Ellen D., aged twenty, domestic, came to the infirmary April 5, 1887, and gave the following history: ten days ago she had an earache, right ear, and the pain has been more or less severe since then. She first noticed a discharge April 1st. To-day there is less discharge, but the pain was very severe last night. The pain is referred to the auditory canal and right occipital region. No pain or tenderness on pressure referred to the mastoid. She complains of tinnitus of a pulsating and singing character. She has always been a strong and healthy woman.

Watch, right ear, $\frac{0}{60}''$. Left ear, normal. The tuning-fork, vibrating and placed on forehead, referred to the right ear. She has naso-pharyngeal catarrh. Right auditory canal contains pus—mem. tympani very much congested and angry-looking. Left mem. tympani retracted and hazy; cone of light very small. The artificial leech was applied and blood withdrawn from a point just in front of the tragus. This eased the pain and tinnitus. She was given drops of atropiæ sulph. (grs. ii.-℥ i.) to be used several times a day.

April 9th.—Somewhat improved, but for two days she has had pain in the left ear. To continue using the same drops.

19*th.*—Hearing distance, watch, right ear, $\frac{1}{60}''$. The pain disap-

pears when the ear discharges. She has had pain at night and some during the day. The mem. tympani is less congested. The ear was inflated gently by Politzer's method, and blood again withdrawn by the artificial leech.

May 21st.—During the past month the patient was seen repeatedly. The pain was better at times, but never absent for long. She was admitted to-day to the infirmary. After ether was given by the house-surgeon, I made a free incision over the mastoid and close to the auricle, down to the bone. No sinus discovered and bone apparently healthy. After dissecting back the periosteum, I perforated the bone with Buck's drill and about half a drachm of pus was evacuated. The cavity was scraped but no communication made with the antrum. The wound was syringed with a solution of bichloride of mercury (1–2000); a plug of gauze inserted in the opening in the bone; iodoform used, and the ear bandaged. The patient had no fever to speak of. She was much relieved by the operation, and had but slight pain at times for a few days afterwards. The ear dressed every day.

June 14th.—Mem. tympani healed; dull red. No pain. General health much improved. Hearing distance, watch, right ear, $\frac{1}{60}''$. She was discharged from the infirmary to-day and treated outside by my assistant, Dr. Garrison.

24th.—Hearing distance, watch, $\frac{3}{60}''$. Sinus behind the ear almost closed and very little discharge.

September 1st.—She was seen at times after this. The hearing distance steadily improved; the sinus closed and she was able to resume her work.

Case 3.—Delia W., æt. thirty-four, married, consulted me May 10, 1887, for pain in the right ear, which she has had since April 10th. For two weeks she has had a swelling over the right mastoid process. Auditory meatus filled with pus and drumhead perforated. The artificial leech was applied over the mastoid.

May 13th.—Pain still present. A Wilde's incision made over the mastoid down to the bone. A poultice to be applied constantly behind the ear.

17th.—She feels much better. She has used the poultice ever since. The swelling has gone down. To continue using the poultice and to syringe the ear.

31st.—The perforation in the mem. tympani closed, but the drumhead still somewhat red, dull, and lustreless. The incision

behind the auricle has healed. Hearing distance, watch, right ear, $\frac{3}{60}$″ ; left ear, $\frac{1}{60}$″.

CASE 4.—Jacob R., fourteen years of age, came to the infirmary May 17, 1887. He said that he has had a discharge from the right ear since childhood. He had an earache last week. Day before yesterday considerable swelling appeared in the temporal region, above the auricle and over the mastoid process. There is a cicatrix in this region from a previous operation. Auditory meatus (right) congested and polypus attached to middle ear. No drumhead visible. Swelling behind auricle soft and fluctuation detected. Incision made ; some pus escaped. Probe passed easily into the mastoid antrum. Polypus removed with the snare.

Hearing distance : watch, right ear, $\frac{9}{60}$″ ; left ear, $\frac{6}{60}$″.

He was directed to syringe the ear with warm water and to apply a poultice over the mastoid process.

May 19th.—The poultice has not been properly applied and the abscess has closed. The swelling behind the auricle much greater. Ether given. An incision three inches long and down to the bone was made behind the auricle and close to its insertion. The pus fairly spurted out, fully an ounce in quantity. A carious opening, $\frac{1}{4}$″ in diameter, found in the bone, in a position slightly above the upper border of the auditory meatus. The mastoid cells were entirely destroyed, and only a shell remained. The cavity was scraped out and the debris removed. A bichloride sol. (1-2000) was syringed freely through the auditory meatus and out of the mastoid opening. A tent of gauze was inserted in the cavity, and iodoform dusted over and a bandage applied.

31st.—A piece of bone came away a day or two ago. The ear and mastoid cavity have been washed out daily with the bichloride solution, and iodoform has been used in the dressings.

June 24th.—The sinus is gradually closing ; the same treatment has been continued.

November 11th.—No discharge from the ear or mastoid cavity. The latter has filled up but little with new tissues. The antrum can be plainly seen through the opening behind the auricle. No trace of a drumhead remains. Hearing distance : watch, right ear, $\frac{6}{60}$″ ; left ear, $\frac{8}{60}$″. The tuning-fork not heard through the air nor by bony conduction.

March 17, 1889.—The boy has been seen during the past two winters repeatedly. There has been a slight moisture at times in the mastoid cavity, which has not filled up to any extent. The

wound has been treated mostly by powders, and the patient has been able to attend to work, and he is much improved in health and general appearance.

May 1st.—The mastoid cavity is now entirely free from any discharge; it is kept packed with antiseptic cotton. The hearing distance has improved slightly for the watch, and his ability to hear ordinary conversation is excellent.

CASE 5.—Mrs. C. S. brought her baby, a few months old, to see me, on account of a discharge from both ears, of a month's duration. The baby was teething. There has been a large swelling above and behind the right auricle for some time. An examination showed presence of pus in both auditory canals. There was well-marked fluctuation over the abscess. An incision was made in it at a point just above the upper wall of the auditory meatus and close to the auricle. Considerable pus escaped, and more or less blood. With a probe it was found that the bone was bare. A tent of lint was inserted in the opening, and I ordered that a flax-seed poultice be applied. She was also told to syringe both ears with warm water, and afterwards instil drops of zinc sulph. (grs. ii.–℥ i.) into the ears.

December 17th.—The bare bone was found covered now and the sinus closing. The ears discharge less. The poultices to be discontinued, and the tent was taken out of the sinus, which was allowed to close. The child was ordered cod-liver oil.

CASE 6.—Kate C——, six years old, was brought to see me January 17, 1888. The mother gave the following history: The left ear has been discharging since she was a year old; the right ear also during the past six months. She has always been delicate. An examination showed that there was a large swelling over the left mastoid process, extending from the upper border of the pinna to at least an inch below the lower border of the lobule, and extending backwards two and a half inches. There is well-marked fluctuation, and pressure over the abscess seems to force out pus from the external meatus. Abscess incised, and a considerable quantity of pus evacuated. No bare bone detected with a probe, and no sinus leading to the mastoid cells detected. She was directed to syringe the ear with warm water, and to use drops of zinc. sulph., and to apply a poultice to the mastoid region. She was also given ℞ Pil. calcii sulph., aa gr. $\frac{1}{10}$—Sig: one three times daily.

January 20th.—Redressed; no pus; opening closing; drops and poultice to be continued. She did not return.

CASE 7.—Maurice G——, forty-six years of age, a cigar-maker, consulted me March 30, 1888, and said that two years ago he first became deaf very suddenly. He was treated at a dispensary, and cured at the end of two weeks. He had no further trouble with his ears, until two and a half months ago. At that time he noticed he did not hear well with the right ear, which discharged freely. This remained so for about two weeks, when the other ear began to discharge, and the hearing became affected. When the left ear began to discharge the right ear began to heal, and in a week all discharge from it ceased. The left ear continued to trouble him, and, at the same time, the tissues behind and below the auricle became inflamed and boggy. This continued to grow steadily worse. There is severe pain behind the ear, and tenderness on pressure. Discharge slight from the meatus. He has pain also in the frontal and occipital regions.

March 31st—Operation: Ether given by the house-surgeon, Dr. Whiting, and assisted by Drs. Garrison and Adams, I enlarged an incision, which had been made the day preceding, over the mastoid and down to the bone, as the patient was relieved but little, and the temperature remained at 99⅘° F. and pulse was 124. He also complained of being chilly, so that I considered an immediate operation justifiable. I pushed back the periosteum, and with a mallet and chisels made a large opening directly behind the meatus, and found pus and broken-down tissue in the mastoid cells. I did not force a passage into the antrum, as it did not seem necessary. The wound was washed out with a bichloride solution, a rubber drainage-tube inserted, and dressed with iodoform and gauze, and bandaged.

8 P. M.—Temperature 98½° F.; pulse, 102. Patient very comfortable, and bore the operation well.

April 1st—Temperature, 99⅘; pulse, 98.

2d.—Temperature—morning, 99; pulse 102. Temperature—evening, 98½; pulse, 96.

8th.—The wound has been dressed daily with bichloride solution and iodoform. The temperature has ranged during the past week between 98⅕°–99⅘°; pulse, 88–108.

13th—Temperature and pulse normal during the past week. The patient was given pills of carbonate of iron, strychnia, and sulphate of quinia, three times daily.

21st.—Hearing distance: watch, right ear, $\frac{8}{60}''$; left ear, $\frac{6}{60}''$. Sinus behind ear closing nicely. Exuberant granulations, touched daily with nitrate of silver. The canal only exists now, which was

made by the drainage-tube, the rest of the mastoid cavity having filled up with new tissue. Membrana tympani dull, lustreless, and retracted. A very minute perforation seen by Valsalvian inflation in the posterior inferior quadrant. Rubber drainage-tube taken out, and the sinus kept open with a tent of antiseptic gauze.

24th.—Hearing distance: watch, right ear, $\frac{8}{60}''$; left ear, $\frac{1}{60}''$. Perforation in drumhead closed; membrana tympani a little clearer. The patient has continued to take the iron pills, together with a bitter tonic before meals, and he has had milk punches from the beginning of his illness. He looks much improved to-day.

May 1st.—Sinus healing rapidly; probe enters but a quarter of an inch. Watch: right ear, $\frac{8}{60}''$; left ear, $\frac{1}{60}''$. Tuning-fork: in the right ear the aërial conduction is better than the bony conduction, while the opposite condition exists on the left side. Left membrana tympani dull and retracted, and almost similar in appearance to the right one. He left the infirmary to-day, but to come in daily to have the ear dressed.

June 30th.—Sinus entirely healed; and he hears the same with both ears.

CASE 8.—John O'K., aged twenty-eight years, came to the N. Y. Eye and Ear Infirmary, May 22, 1888, and gave a previous history of mastoid disease on the right side, and showed the cicatrix over the mastoid process, made at an operation eight or nine years ago. Eight months ago the left ear pained him, and he thought that something burst in the ear, and since November there has been a discharge. Since Christmas there has been a swelling behind the ear, and a discharge from a sinus, an incision having been made in this region by a doctor at the time.

The patient is run down, but gives no history of syphilitic disease. No appetite. He has some fever, and cannot sleep. Admitted to the infirmary to-day.

Hearing distance—watch: right ear, $\frac{1}{60}''$; left ear, $\frac{6}{60}''$. Tuning-fork: Bony conduction better than the aërial for both ears. The tuning-fork, when placed on the vertex, heard louder in the left ear.

Right mem. tympani dull and hazy in appearance, and retracted.

Left meatus contains pus. There is a large swelling behind the left ear, extending down the neck. Fluctuation well marked. A sinus leads directly inwards to the mastoid cells, which are carious.

May 22d.—Operation: An incision was made behind and close to the auricle, about two inches in length, down to the bone.

Quite a large carious opening was found in the bone and leading to the mastoid cells. Carious opening enlarged, and carious cells and granulations and broken-down tissue and cheesy matter removed with a curette. Drainage-tube inserted, and mastoid cavity washed with bichloride solution and dressed with iodoform and gauze, and a bandage applied.

The patient came out of the ether, having stood the operation well.

23d., A.M.—Pulse, 108 ; temp., 99⅘°. P.M.—Pulse, 106 ; temp., 98¼°. Wound dressed as before.

29th.—Ear and mastoid cavity dressed daily. No elevation of temperature at any time. The cavity filling up with new tissue Very little discharge.

June 1st.—Patient allowed to leave the infirmary, but to come in daily to have the ear attended to.

21st.—He has been in almost every day since. The sinus behind the ear has closed now, and the drumhead is healed. Hearing much improved, and he was discharged cured.

CASE 9.—A. A., twenty-one years of age, Norwegian, consulted me May 11, 1888, and said that he has had a discharge from the right ear at times, since he was a child. He has occasionally had more or less pain in the ear. Three years ago the right ear commenced to discharge, and this continued for about a year. It seemed to be cured, and caused him no further inconvenience until six months ago. Since then there has been a constant discharge. His general condition has been fairly good, but he is anæmic. At present there is a profuse discharge from the ear, and on examination with a probe I discovered a very small sinus in the posterior wall of the bony auditory canal, leading backwards and inwards into the mastoid cells. Carious bone felt with the probe, and cheesy matter comes out of this sinus. No swelling nor pain about the mastoid process. Left mem. tympani very much retracted, but fairly normal as to color.

Operation : Ether given. I made an incision about two and a half inches long just behind the auricle, down to the bone, and pushed aside the periosteum. An opening about half an inch in diameter was made with chisels and mallet in the bone, just behind the auditory meatus. The mastoid cells were found entirely destroyed, and the cavity filled with a very thick, cheesy, fœtid matter, cholesteatomatous in appearance, and so thick that it could not be syringed out. The entire contents were removed

with a curette and by syringing, the water passing freely through the antrum and external meatus. After thorough irrigation of the wound with bichloride solution, the cavity was packed with iodoform gauze and a bandage applied.

Temperature, 99½° F.; pulse, 64. He complains of little pain, and stood the operation well.

May 25th.—The mastoid cavity has been dressed daily with bichloride solution and iodoform, and to-day a drainage-tube was inserted instead of packing the cavity with antiseptic gauze. Hearing distance, watch, right ear, $\frac{0}{6}''$; left ear, $\frac{1}{6}''$. The watch is heard with the right ear, when placed on the right temple. When the tuning-fork is placed on the vertex or teeth, it is heard slightly better with the left ear. The bony conduction is better for both ears than the aërial conduction.

30th.—Pulse, 72; temp., 99⅘. The same treatment continued and the cavity has been slowly filling up.

June 9th.—Patient allowed to leave the infirmary, but to come in to have his ear dressed. Since May 30th there has been no rise in temperature.

21st.—Exuberant granulations cauterized with nitrate of silver. Discharge not very healthy and of a disagreeable odor. Dressed in the same way.

23d.—There has been no pain at all about the ear. Sinus nearly healed. Watch, right ear, $\frac{3}{10}''$.

30th.—Sinus all but healed. No discharge from it nor from the ear. Right mem. tympani adherent more or less to inner wall of tympanum and composed mostly of cicatricial tissue.

Case 10.—Henry de G——, twenty-two years of age, consulted me October 17, 1888, and said that he had always been healthy and never had any ear trouble before last July, when he had an earache on the left side, from a cold in the head, as a result of sea-bathing. The ear commenced to discharge about August 1st. He has had severe pain all the time, but especially at night. He has been deaf in the right ear since a child, as a result of a fall.

On July 11th, my assistant, Dr. Garrison, made a Wilde's incision over the mastoid (left) down to the bone, which he found bare and evacuated some pus. The pain was relieved as long as the wound was kept open. I saw him for the first time on October 9th. The sinus had again closed and the pain had recommenced. I opened the sinus and allowed some pent-up matter

to escape, and with a probe, detected carious bone and passed it into the mastoid cells. A rubber drainage-tube was inserted and the sinus washed out with a bichloride solution and dressed with iodoform and bandaged. Left mem. tympani sodden and somewhat congested above. No perforation seen nor heard when the patient inflated the ear by the Valsalvian method. Right mem. tympani dull, retracted, and lustreless. Hearing distance: watch, right ear, $\frac{0}{60}''$, heard only when placed on the mastoid process or right temple; left ear, $\frac{12}{60}''$. Tuning-fork heard only on the right side, when placed on the mastoid process. On the left side the aërial conduction is better than the bony.

October 17th—Operation: Ether given. I made an incision two inches long, just behind the auricle and close to it, down to the bone and pushed back the periosteum. I found a carious opening in the bone, about the middle of the process, leading into the mastoid cells. This I enlarged slightly, with chisels and mallet. Very little if any pus found in the mastoid, which was found filled with softened bone and granulation tissue, all of which I removed with a sharp spoon, leaving a considerable cavity. This was washed with a bichloride solution (1-2000) and dressed with iodoform and bichloride gauze, a silver drainage-tube having first been inserted into the cavity and held in position by a suture through the integument and fastened to a small opening in the tube. The edges of the incision were brought together by suture above and below the tube, a piece of gauze soaked in bichloride was laid over the wound and a bandage applied.

November 23d.—The patient had little, if any, rise in temperature after the operation, which he bore very well. There was primary union of the edges of the wound, which were brought together by suture. The same treatment was carried out with the bichloride solution and iodoform. Watch, left ear, $\frac{8}{60}''$. Left auditory canal somewhat narrowed and congested still, with the dermal layer peeling off. Mem. tympani dull, and opaque, and congested along the handle of the malleus. A few days after the operation, the silver tube was removed and a smaller one introduced, and to-day this one was taken out. The mastoid cavity has filled up with new tissue with the exception of the canal kept open by the tube. A tent of antiseptic gauze was inserted to-day in the sinus and the wound dressed as before.

30th.—The integument had closed over the sinus to-day, so that Dr. Adams, the house-surgeon, found it necessary to open it again and pack it with iodoform and gauze.

December 15th.—Since November 30th, the sinus has been kept open by packing it with gauze soaked in bals. of Peru, as a dressing. There is still a carious point detected with the probe.

February 15th.—It has been difficult to keep the sinus open externally. Still a carious point in the mastoid cavity. The sinus was dressed as before, with Peruvian balsam until February 1st, when I substituted alcohol and iodoform, which I dropped daily into the wound with marked benefit. I gave him at times tablets of chloride of gold and sodium, aa. gr. $\frac{1}{10}$, three times daily, as well as Fellows' comp. syr. of the hypophosphites and a tonic of iron and quinine.

April 22d.—The sinus closed April 10th. There is no pain in the ear nor mastoid. No tenderness over the mastoid on pressure.

CASE 11.—Edward V., native of Germany, forty-two years of age, a driver, was admitted to the infirmary April 2, 1889.

He has always enjoyed good health. No history of syphilis or tuberculosis. He has never had trouble with his ears previous to the present attack. He caught a severe cold six weeks ago, and in the course of a few days the right ear became painful, with the hearing impaired, and a few days later there was a discharge from the ear. The pain and discharge ceased at the end of two weeks, but leaving the patient deaf in the right ear. At this time (four weeks ago), the left ear became painful and the hearing impaired, followed in the course of a few days by a discharge of pus from the canal. The pain continued for about two weeks. Two weeks ago, the right ear became again affected, the pain being more severe and not confined to the ear alone, but extending over the side of the head. There was a discharge from the ear until six days ago.

Four days previous to his being admitted to the infirmary, as he complained of pain and tenderness on pressure over the mastoid, leeches were employed in that region.

When admitted the patient was pale and thin, with an anxious expression, and suffering severe pain in the right ear and side of the head. No discharge from the ear. Mastoid region swollen and very tender on pressure. Very deaf in both ears. Pulse 80 and feeble. Temperature not taken. He has not had any distinct chill.

Operation.—Patient etherized and an incision, two inches long, made from the upper border of the auricle downwards and close

to it, in the mastoid process. No pus found, but the bone was bare and rough, and the periosteum separated. With chisel and mallet I made an opening into the cells, at a point just above and behind the external meatus. I entered the antrum but found no pus until I pushed a director downwards into the apex, when about two drachms were evacuated. Soft granulation tissue and some carious bone were removed with the sharp spoon. The wound was washed with the bichloride solution and dressed with iodoform and gauze. A rubber drainage-tube was introduced into the wound, and the upper edge of the wound brought together with silk sutures. The wound covered with antiseptic gauze and bandaged.

The patient bore the operation well. 8 P.M.: temp., 103⅘° F.; pulse 78.

April 3d.—8 A.M.: temp., 99⅗° F.; pulse, 56.
4 P.M.: temp., 102⅘° F.; pulse, 66.
6.30 P.M.: temp., 103° F.; pulse, 68.

The temperature did not rise any higher during the day than 103° F.

April 4th.—8 A.M.: temp., 99⅘° F.; pulse, 67.
1 P.M.: temp., 104⅗° F.; pulse, 72.
6 P.M.: temp., 104⅘° F.; pulse, 80.
11 P.M.: temp., 102⅘° F.; pulse 68.

The patient was given antipyrine at first and afterwards quinine in moderate doses, besides milk punches and beef tea. Dr. Robert F. Weir saw him with me in consultation, and it was decided best to discontinue the antipyrine and quinine and to watch the variations in temperature, as it was suspected that there might be a cerebral abscess, although he complained of no pain. He complained of being chilly at times, but had no regular chill. He perspired but little. The eyes were examined but nothing abnormal found about the fundus.

5th.—8 A.M.; temp., 98⅘° F.; pulse, 62.
11 A.M.; temp., 97⅘° F.; pulse, 45; resp., 18.
2 P.M.; temp., 101° F.; pulse, 70; resp., 20.
7 P.M.; temp., 104⅘° F.; pulse, 72; resp., 24.

6th.—8 A.M.; temp., 101⅕° F.; pulse, 72; resp., 24.
3 P.M.; temp., 103⅘° F.; pulse, 75; resp., 24.
9 P.M.; temp., 103⅘° F.; pulse, 79; resp., 28.

The pulse has gradually become more rapid and feeble. He was given quinine in 5-gr. doses several times a day, besides whiskey and milk and beef tea.

7th.—8 A.M.; temp., 101¾° F.; pulse, 92; resp., 24.
2 P.M.; temp., 103⅘° F.; pulse, 100; resp., 36.
The wound looks fairly well, and has been dressed daily with the bichloride solution and iodoform.
11 P.M.; temp., 102⅘° F.; pulse, 82; resp., 25.
8th.—8 A.M.; temp., 102⅕° F.; pulse, 64; resp., 24.
2 P.M.; temp., 103⅘° F.; pulse, 61; resp., 24.
11 P.M.; temp., 102⅕° F.; pulse, 95; resp., 36.
10th.—8 A.M.; temp., 101⅘° F.; pulse, 100.
2 P.M.; temp., 103⅘° F.; pulse, 101.
7 P.M.; temp., 101⅘° F.; pulse, 102.
11th.—8 A.M.; temp., 101⅘° F.; pulse, 80.
2:30 P.M.; temp., 102⅘° F.; pulse, 100.
11 P.M.; temp., 100⅕° F.; pulse, 86.
12th.—The highest point reached to-day by the thermometer was 101¾° F., at 2 P.M.
13th.—8 A.M.; temp., 101⅕° F.; pulse, 88.
3 P.M.; temp., 102⅕° F.; pulse, 100.
9 P.M.; temp., 102⅕° F.; pulse, 94.
The same treatment has been carried out daily, viz., whiskey and milk and quinine, and the wound has been washed as before. Discharge very slight.
14th.—8 A.M.; temp., 100⅗° F.; pulse, 94.
2 P.M.; temp., 102⅘° F.; pulse, 68.
15th.—8 A.M.; temp., 100⅘° F.; pulse, 64.
11 A.M.; temp., 101⅗° F.; pulse, 92.
An examination of the chest to-day showed the presence of some pleuritic friction sounds and diffused râles over both lungs. He was given digitalis in small doses.
16th.—8 A.M.; temp., 100° F.; pulse, 84.
3 P.M.; temp., 101⅕° F.; pulse, 95.
7 P.M.; temp., 100⅕° F.; pulse, 76.
17th.—8 A.M.; temp., 100⅘° F.; pulse, 78.
2 P.M.; temp., 101⅕° F.; pulse, 98.
7 P.M.; temp., 102° F.; pulse, 88.
18th.—8 A.M.; temp., 100⅕° F.; pulse, 78.
3 P.M.; temp., 102⅖° F.; pulse, 82.
11:30 P.M.; temp., 99⅘° F.; pulse, 81.
19th.—8 A.M.; temp., 100⅕° F.; pulse, 90; resp., 24.
1:30 P.M.; temp., 101⅗° F.; pulse, 100; resp., 26.
20th.—8 A.M.; temp., 98° F.; pulse, 76.

8 P.M.; temp., 101⅘° F.; pulse, 78; resp., 27.

21st.—8 A.M.; temp., 97° F.; pulse, 80; resp., 24.

9 P.M.; temp., 101⅘° F.; pulse, 95; resp., 24.

22d.—Temperature normal all the morning, but it rose to 101⅘° F. at 7 P.M.

23d.—The temperature did not rise above 99⅘° F. to-day.

28th.—The temperature has steadily become lower, and the patient has been gradually improving. The chest has been clearing up, and the cough becoming less. The patient's appearance has changed very much, and he no longer has an anxious expression. Peruvian balsam has been used instead of the iodoform in the wound, and a tent of gauze has been used instead of the rubber tube. The mastoid cavity is gradually filling up with new tissue. The patient begins to eat well now, and has been allowed some solid food.

May 10th.—Opening into the mastoid at present is very small. Only one or two bare points felt with the probe. Almost the entire cavity filled with new dense tissue. Left mem. tympani dull, lustreless, and thickened. Right external meatus contains some cerumen and powder, which was removed. Mem. tympani dull, red, and thickened. Tuning-fork on vertex heard louder with the left ear. The aërial conduction better on both sides than the bony. Watch: right ear, $\frac{1}{60}''$; left ear, $\frac{1}{60}''$. The sinus is kept open with a small tent of iodoform gauze and a piece of rubber plaster over it. Patient allowed to sit up each day for a short time.

24th.—The patient has been gaining steadily in every way. Sinus behind ear entirely closed now.

Watch: right ear, $\frac{10}{60}$; left ear, $\frac{0}{60}''$. He hears ordinary conversation now quite well. Right mem. tympani dull, lustreless, opaque; no cone of light. Left mem. tympani dull and reddish, and canal slightly congested. This ear has annoyed him slightly for a few days past with slight pain and tinnitus. The ears were inflated after Politzer's method, and he was given drops of zinc. sulp., grs. iv.—℥ i., to instil in the left ear.

June 1st.—He has been cared for as an out-patient for some days past, and is steadily improving.

CASE 12.—Katie S——, native of the United States, 7 years of age, came to my clinic at the infirmary, April 23, 1889. Her mother said that she has never had any ear disease before the present trouble, and has always been a strong, healthy child,

until about fourteen months ago, when she had scarlet-fever, followed by diphtheria. The right ear pained her at the time and there has been a discharge from it ever since. She has had several abscesses in the neck opened. There is at present a very offensive discharge from the ear and also from a sinus behind the auricle, leading to the mastoid antrum. A probe reveals carious bone.

April 24th. Operation: Ether given by Dr. Adams, house-surgeon, and assisted by Dr. Gibson, I made an incision two inches long, down to the bone, laying open the sinus, and found a large carious opening into the mastoid, about half an inch in diameter. Most of the posterior bony auditory wall was destroyed and the carious process involved the tympanic cavity. Two large sequestra of bone were removed. The drumhead and ossicles were entirely destroyed. All the carious bone, granular tissue and débris were removed with a sharp spoon and chisels, nothing remaining of the mastoid but a mere shell. A rubber drainage-tube was introduced from behind and brought out through the external meatus, also a larger tube into the mastoid cavity. After thorough irrigation of the wound with the bichloride solution, iodoform and antiseptic-gauze dressing was applied and the ear bandaged.

26th.—Ear dressed to-day and the wound looks very well. No rise in temperature and no pain since the operation.

1st.—The child out of bed and around the ward and feeling very well. The ear has been dressed about every other day.

14th.—Opening in the bone gradually getting smaller. She hears ordinary voice close to the ear. Mastoid cavity filling up. The drainage-tube, running through from the posterior opening and out of the ext. auditory canal, was removed a few days ago, and the other one was taken out to-day. Only one bare point of bone was discovered. Discharge slight. Dressed as before except that a tent of gauze was substituted for the rubber tube. Tuning-fork when placed on vertex and vibrating, heard better with the right ear.

24th.—Sinus behind right ear closed and mastoid filled up with new tissue. Very little discharge from the ear. Some powder of zinc ox. et acid. borac. insufflated. Left ear has been discharging for the past few days. Ordered to syringe the ear and use drops of zinc. sulph. (grs. iv.-℥ i.). She was also given syr. ferri iod., gtt. xv., three times daily.

June 4th.—There has been some discharge from the right ear, probably caused by a sequestrum (very small) of bone, removed to-day with forceps. Zinc. oxid. et acid. borac. powder was insufflated. To continue same drops in the left ear.

CASE 13.—John D——, æt. twenty-five, a clerk, consulted me in the latter part of April, 1885. He said he has never had ear trouble before. He frequently has a "cold in his head." His appearance does not denote very robust health. He is a dyspeptic, and has to be careful about his diet. Ten years ago he had typhoid fever and pleurisy at the same time. He has also had scarlet-fever, measles, and diphtheria twice, but some years ago. The present ear disease commenced the middle of February and was caused by his sniffing up some glycerine to relieve a bad "head cold." On the following day, he awoke with a dull feeling below the right mastoid. The ear discharged the next day, and he had pain for several days. The discharge at first contained mostly mucus, but afterwards pus. He consulted two physicians, and was treated by them for two months, the treatment consisting in douching the ear with warm water and the application of nitrate of silver. He derived no benefit, however, the pain and discharge continuing.

When he came to me, an examination showed that he had hypertrophic nasal catarrh, with the septum deviating to the right side, so that the passage was very much contracted.

Left mem. tympani, dull, lustreless in appearance; somewhat sodden, and it does not move when the air is exhausted by Siegle's otoscope. No cone of light. The right mem. tympani considerably destroyed and the external meatus narrowed. The posterior bony auditory wall congested and sensitive when touched with a probe. A hard polypoid mass above and coming apparently from the antrum.

Hearing distance: acoumeter, right ear, $\frac{1}{2}''$; left ear, $4''$. He hears only loud voice. Tuning-fork vibrating and placed on the vertex cranii, heard a little louder in the right ear. The bony conduction is better than the aërial for both ears. The discharge from the right ear, darkish brown and offensive. The polypoid mass was cauterized several times and the ear treated with different powders (dry method) with some improvement, as the discharge became less and the hearing distance for both ears was increased by means of Politzer inflation. The improvement was but temporary, however, as the auditory canal (right) became

narrower and more painful in the posterior bony portion. He had pains, at times referred to the right mastoid, and there was a very tender spot on pressure just behind the auricle and near the antrum.

The symptoms all pointed to carious bone in the mastoid, so that I decided at once to perforate the mastoid process.

June 2d.—Ether given by the house-surgeon, Dr. Lewis, I perforated the bone with Buck's drills, just behind the ext. meatus and found pus and granular debris, which I scraped away, and passed a director well up into the antrum.

The wound was washed with a bichloride solution, and dressed with iodoform, and a tent inserted to keep the wound open. The patient was kept in bed for a few days, suffering but slight discomfort, and with little if any elevation of temperature.

6th.—Patient improving. Discharge from the canal less, and mastoid dressed in the same way.

Hearing distance, acoumeter, right ear, 10″; left ear, 4″. Tuning-fork on vertex, heard a little better with the right ear. The lower notes of a Galton whistle heard quite plainly across a room, a distance of 15 feet, but the high notes heard only at the distance of a few inches.

7th.—He says he hears very much better since yesterday afternoon, when the discharge first came from the opening in the mastoid. No discharge now from the ext. meatus. No pain. Same treatment continued. Eustachian catheter used in the left ear.

23d.—Hearing disturbance for the voice much improved.

July 7th.—The patient was allowed to leave the infirmary soon after the operation, and treated as an out-patient. He has had some cold in his head, and the discharge from the ear is increased in quantity. The canal is well dilated now, the perforation is closing gradually, and the polypus has disappeared. Sinus behind the ear gradually closing also. He was given pil. ferri et quiniæ cit., āā gr. ij., three times daily. The ear was treated by the insufflation of powders.

October 22d.—The discharge from the ear ceased about August 20th, and there was gradual improvement in the patient's condition, and the sinus closed some time before the ear stopped running. Acoumeter: right ear, 5½″; left ear, 2″. After the use of the catheter: right ear, 13″; left ear, 2″. He hears ordinary conversation much better than ever before. No perforation in the

drumhead, which is somewhat congested about Shrapnell's membrane and opaque below. There is some tinnitus, which has been present ever since the commencement of the attack, but otherwise he is well.

CASE 14.—Ferdinand V——, seven years of age, was seen by me February 26, 1889. His father said that a year ago he had a noise in the left ear, and some wax was removed. Three weeks ago he had measles, and for the past two weeks the left ear has pained him. Ten days ago a swelling appeared behind the left ear, when the pain in ear became less. The pain has been worse at night, and he has had some fever.

An examination showed that there was some cerumen in the left meatus. On removing this the dermal layer of drumhead and ext. meatus was found peeling off. No perforation in the mem. tympani, which is dull red. A large abscess exists behind the auricle, with well-marked fluctuation, extending from the ext. meatus upwards to one half an inch above the upper border of the auricle and backwards for nearly two inches from the attachment of the auricle.

He has enlarged tonsils and chronic naso-pharyngeal catarrh.

An incision was made in the abscess, and half an ounce of pus and blood evacuated. A probe introduced, touched carious bone and entered the antrum. Abscess cavity washed well out with a carbolic-acid solution, but no liquid could be forced through the mem. tympani from the posterior opening. A tent of antiseptic gauze inserted to keep wound open, and iodoform dusted over and a bandage applied. He was given syr. ferri iod., gtt. x., to be taken three times daily.

March 15th.—The sinus has been washed out every two or three days with carbolic solution and drops of alcohol and iodoform instilled. The bone is still bare, but is gradually being covered over. Some granulations have been touched with nitrate of silver. The bandage was left off yesterday and rubber plaster used instead. The auditory canal contained some epidermal scales, which were removed and some boracic-acid powder insufflated.

19th.—Mem. tympani clearing up, and but slightly congested now. To continue the iron. Sinus closing slowly.

29th.—Drumhead looks fairly normal now. Hearing distance, watch, $\frac{3}{60}$′. Right canal contains some cerumen, which was removed. Sinus behind ear entirely healed. No pain nor tenderness on pressure. Ears inflated by Politzer's method.

CASE 15.—Daniel McA——, aged thirteen years, came to the infirmary April 19, 1889, and said that last night he had sudden pain in the right mastoid process, and the swelling appeared behind the ear, which stands out prominently. Pain severe all night. He has been attending here for the past six weeks, as the right ear has been discharging, and he has been using the warm-water douche and drops of sulphate of zinc (grs. iv.-℥ i.), and the discharge has been growing less.

The house-surgeon, Dr. Adams, under my directions, made a Wilde's incision down to the bone. The periosteum was found loosened and the bone bare over an area of about a quarter of an inch.

The wound was washed with a bichloride solution ($\frac{1}{2000}$) and dressed with iodoform and a tent inserted to keep it open. A bandage was applied, and he was allowed to go home after the effects of the ether had passed off.

April 21st.—Ear dressed to-day as before. No pain since.

26th.—The ear has been dressed twice since in the same way. There has been some muco-purulent discharge from the ear to-day, although since the Wilde's incision it has been quite dry. Ear syringed with warm water and he was directed to use zinc drops at home, several times a day. Mem. tympani has a large perforation. Wound behind the auricle healthy and granulating from the bottom, although the bone is still bare. Hearing distance, watch, right ear $\frac{1}{60}''$. Left meatus filled with cerumen: removed by syringing.

May 3d.—Less discharge from the ear. Bone gradually being covered. Same treatment continued.

7th.—The pain commenced again, and as the bone was still bare and the ear discharging, and the meatus contained granulations so that it was difficult to see the drumhead, I again gave him ether and made an incision down to the bone, commencing at the upper border of the pinna and carrying it downwards for two inches, close to the attachment of the auricle, joining at an acute angle with the previous incision. The bone was found very soft and the mastoid was easily perforated with chisels and mallet and soft bone and granulations were removed. The size of the opening in the bone was about a quarter of an inch and on a level with the upper border of the external meatus.

No communication through the antrum could be easily established, as the bone was hard. The mastoid cavity and ear were

thoroughly washed with bichloride solution and dressed with iodoform, and a gauze tent inserted in the wound and a bandage applied. The patient was kept in bed and bore the operation well.

25th.—There has been no rise in temperature to speak of, and the wound, which has been dressed in the same way, has been healing nicely. No discharge from the ear. Sinus still open, but the opening in the mastoid has closed. The bandage was left off to-day, a tent of gauze being inserted and kept in position by rubber plaster over it.

28th.—Right mem. tympani still perforated, but no discharge from the ear. Very little congestion. Powder of zinc. oxid. et acid. boracic. insufflated.

Left mem. tympani somewhat retracted, thickened especially in the posterior half. Cone of light small. Hearing distance: watch, right ear, $\frac{4}{60}''$—left ear, $\frac{3}{60}''$. The tuning-fork, when vibrating and placed on the vertex, heard better with the right ear. The aërial conduction better than the bony conduction for both ears.

June 4th.—Sinus all but closed. Perforation still seen in the drumhead, but there has been no discharge. The patient allowed to leave the infirmary.

CASE 16.—Andrew B——, aged 30, a Swede, came to the infirmary October 24, 1888. He said that he has never had any trouble with his ears before the present attack. About a year ago, he had a bad cold, followed by pain and discharge in the left ear. He had also more or less pain behind the ear. There has been more or less discharge from the ear since last November. Last August, he again had pain in the mastoid, and a doctor made an incision there in September. He was told to syringe the ear with warm water and instil some drops, and to apply a poultice over the mastoid.

Examination.—Hearing distance for the watch, left ear, $\frac{0}{60}''$. Tuning-fork, when placed on the mastoid, heard louder in the left ear. A sinus exists behind the auricle, the external opening being about two inches from the insertion of the pinna and on a level with the lower border of the lobule. A probe introduced passed readily into the mastoid cells.

October 24th.—Operation: The patient was etherized by the house-surgeon. I then made an incision, two inches and a half long, just behind the auricle, in the mastoid, down to the bone. A

carious opening found ; this was enlarged with chisels and a sharp spoon and about half a drachm of pus and granular tissue were removed. The cavity was thoroughly washed out, in the usual way, with a bichloride solution. A silver drainage-tube was inserted and the wound was dressed with iodoform and gauze. The edges above and below the tube were brought together by silk sutures, and considerable granulation tissue was scraped away in the track of the original sinus. The patient came out of the ether well and passed a good night.

25th.—Temperature, 8 A.M., normal. 7 P.M., 101° F.

26th.—8 A.M., temperature 98½° F. 8 P.M., 100 ° F.

Wound dressed and found healthy-looking. A small pocket, just behind and below the apex of the mastoid, was laid open and scraped the day of the operation. A probe shows that the collection of matter in the mastoid had made a sinus through the tip of the process and burrowed beneath the deep tissues, in a direction backwards, downwards, and inwards.

November 1st.—The wound has been washed in the same way. The mastoid has filled up somewhat with new tissue, but the pocket below is slow in healing. The patient has had no elevation of temperature to speak of.

December 17th.—An operation was decided upon to-day, as the sinus has not healed at all, although a solution of nitrate of silver has been injected repeatedly to stimulate it, as well as bals. of Peru, but there has been a tendency for the pus to collect at the lowest point, and there is some induration of the tissues. Ether given by Dr. Gibson and assisted by the house-surgeon, Dr. Adams, I introduced a probe, which passed downwards, backwards, and inwards for a distance of at least four inches, towards the third cervical vertebra. No carious vertebra discovered. An incision was made through the tissues externally at the lowest point, so that the probe came through. A director was then substituted for the probe and the entire sinus laid open, so as to allow it to granulate up from the bottom (see fig. No. 1). There was also found to exist a second pocket, starting from the upper opening of the first sinus and leading forwards towards the angle of the jaw. The free incision seemed, however, sufficient to drain this. The bichloride solution (1–1000) was used, and a rubber drainage-tube inserted and passed inwards and forwards towards the angle of the jaw. It was then packed with iodoform gauze. The mastoid was found to contain soft granulations, and on re-

moving these some bone was felt with the probe. A very small silver tube was reintroduced in the mastoid. The whole was then dressed with iodoform and gauze applied.

19*th.*—Wound dressed to-day. Very little discharge and every thing looks well. Patient out of bed this afternoon. No elevation of temperature.

February 1*st.*—The mastoid and sinuses have been dressed daily with the bichloride solution and iodoform. Bals. of Peru has also been used at different times. There has been considerable difficulty in getting the cavity to heal up from the bottom. The lowest part has filled up, but a sinus has remained, running in a direction forwards and slightly downwards and outwards. A

FIG. 1.

small opening still remains in the mastoid. This latter, as well as the other sinus, has been stimulated with comp. tr. benzoin. and iodoform in alcohol.

10*th.*—Patient left the infirmary to-day, but he is to come in to have the wound dressed every day. He was given a tonic of iron and quinine, and is improving steadily in appearance and general health.

15*th.*—To-day I began using as a stimulating injection, ℞ Zinc. sulph., cupri. sulph., each fifteen parts; liq. plumbi subacet. thirty parts, and vinegar 300 parts, diluting it one half with water. Both sinuses began to close and improve at once.

April 1*st.*—The sinus below the mastoid has closed, and the one in the mastoid is steadily growing smaller.

May 4th.—Sinus in mastoid closed (see fig. No. 2). Hearing distance: watch, right ear, $\frac{34''}{60}$; left ear, $\frac{P}{60}$. Watch is heard also, when placed on the left mastoid and temple. Some scales and a little thick pus in the lower part of the left auditory meatus were removed to-day and boracic acid insufflated. There is a small perforation in the lower anterior quadrant. Right mem. tympani fairly healthy in appearance, but showing evidences of catarrhal changes. The patient has also chronic atrophic rhinitis.

18th.—For several days he has felt very badly, suffering from headache, general malaise, loss of appetite. He has some fever, and an examination of the chest showed that there was bronchial breathing at the apex and upper lobe of the left lung, and well-

FIG. 2.

marked symptoms of phthisis. He was sent to the N. Y. Hospital for treatment.

July 25th.—The patient has been improving under treatment and a report from the hospital to-day says that "the patient has cavities in each lung; a condition of pneumothorax in the right lung posteriorly; some dyspnœa; pleuritic adhesions; lung bound down at the base. He goes out of the hospital every day for an hour or so, and were it not for his dyspnœa one would think him a very strong and robust fellow."

If we are fortunate enough to see an acute case of mastoid disease, whether inflammation of the periosteum or

of the cells, we can frequently cut short the disease by local abstraction of blood. For this purpose I have used for several years a scarificator (Fig. 3.), and cupping-glass (Fig. 4.), which I have described in the *N. Y. Med. Journal* and also in the Transactions of the N. Y. State Med. Society for 1889.

The most thorough antiseptic precautions should be carried out on the part of the operator and his assistants. The instruments should be thoroughly cleansed. When about to perforate the mastoid process, the parts should be first shaved and cleansed with a solution of bichloride of mercury (1-2000). The incision should be made a quarter

Fig. 3.

Fig. 4.

of an inch behind the insertion of the auricle, and from one and a half to two inches in length, and even longer when the tissues are swollen. The periosteum should be divided and pushed aside. In cases where a fistula exists it is best to enlarge it by means of a chisel or sharp spoon. When no fistula is found in the bone, no soft spot, it is well to perforate the mastoid about one quarter of an inch below the linea temporalis (*i. e.*, a point slightly below and behind the superior wall of the external auditory canal). Grooved chisels should be used at first and a funnel-shaped opening made, with the apex pointing inwards. The outer table of the bone is usually one fifth of an inch in thickness. The

bone should not be entered to a depth greater than three fourths to five eighths of an inch, so as to avoid injury to the facial canal and external semicircular canal. There is also danger of wounding the lateral sinus and the dura mater in either the posterior or middle fossa, unless we use the chisels in a direction forwards and inwards and take off layer by layer of bone. After penetrating the outer wall of the mastoid, all pus and cheesy matter should be carefully removed, as well as any carious bone and granulations. It is best to enter the antrum in all cases if possible, so as to wash out any cheesy products which are liable to lodge there. We should not fail to investigate the apex, when we do not find pus in the antrum or upper portion of the process. This was the case with one of my patients—viz., case No. 11. Otherwise there is great danger that the pus may burrow down the side of the neck beneath the deep muscles. This happened in case No. 16.

Bezold (in *Deut. Med. Wochen.*, July 9, 1881) describes this rare form of mastoid disease, where perforation occurs on the inner surface of the mastoid in the digastric fossa. Pomeroy, in his "Treatise on the Ear," also mentions it.

After the mastoid cavity has been entirely freed from all pus and débris, it should be thoroughly irrigated with a bichloride solution (1-2000) and where possible, the water should be made to flow from the mastoid out through the antrum and external meatus. A rubber drainage-tube or a silver tube with lateral openings, or a tent of antiseptic gauze, should then be inserted in the cavity. Iodoform should be used in the dressing. After the rest of the wound has been packed with iodoform a bichloride gauze, or several layers of gauze soaked in the bichloride solution, should be applied over the mastoid. Then the whole should be covered with a layer of cotton and bandaged.

In ordinary cases, the patient should be kept in bed several days and allowed a light diet. The dressings should not be disturbed for thirty-six to forty-four hours unless the patient complains of pain or there should be some rise in temperature. In severe cases and where symptoms of septicæ-

mia exist, it is necessary to change the dressings often. In regard to the operation of perforating the mastoid, I quite agree with Rossa who says: "It is after all a plain surgical operation, which no man with any considerable experience in general surgery, need hesitate about, when it is indicated."

THE IMPROVEMENT IN HEARING OBTAINED BY THE ACTION OF INTENSE SOUNDS IN CASES OF CERUMINAL PLUGS.

By W. KOSEGARTEN, of Kiel.

Translated by Dr. J. M. Mills, of New York.

OBSERVATIONS in different directions induced me to try whether or not the acuteness of hearing—dulled by disease, as I supposed—could be raised by the action of intense sounds.

The greatest acuteness of hearing was first noted, then a hand-bell rung in front of the ear, and the hearing-distance immediately measured, and later, after from 5 to 15 minutes, the hearing acuteness was measured again.

There were ninety-four cases under observation. Unfortunately, the limited time and press of professional duties prevented me, at times, from recording the result, after syringing (twenty-four cases). However, in nine cases there was positively no improvement in hearing after the syringing; therefore these are not taken into consideration. Of the remaining eighty-five, there was decidedly an improvement in sixty-seven cases after the ringing of the bell; in fifty-two cases immediately after the ringing; and a few minutes later an improvement was found to be present in sixty-four cases. In three cases the improvement, appearing immediately after the ringing, disappeared in a short time, while in thirty-four cases the improvement immediately obtained increased still more later on. In twelve instances the acuteness of hearing was no better immediately after the ringing, but in a few minutes it increased. Three times the hearing-distance was somewhat diminished immediately after the

ringing, but in a few minutes it rose above the first measurement. This decrease, noticed immediately after the ringing, was most likely due to the deafening produced by the very intense sound.

The amount of improvement varied extraordinarily; at times it was considerable; for example, the hearing-distance increased from 4 to 20, 6 to 29, 1 to 27, 2 to 14, 11 to 70, 4 to 22, 19 to 40, etc.

In ten cases of bilateral occlusion, twice the improvement was about the same in both ears; in two cases it was greater in the better ear; whereas in six instances it was greater in the worse ear. If I am warranted in drawing conclusions from these few observations, then it could be assumed that the better ear had been used more, as ordinary sounds could penetrate into it more easily than into the ear which was more firmly closed.

Upon the whole, my suppositions were confirmed; in by far the majority of the cases the improvement in hearing assumed beforehand was really obtained after the ringing of the bell; and, in fact, several times the improvement was so marked that several colleagues, who were present, were astonished at the experiment. The explanation that the ceruminal plug pressing upon the drum was loosened by the sounds could not be accepted; for it would be exceptional for the plug to be situated so deep in the canal as to press upon the drum-membrane. Another explanation does not occur to me, and consequently the result appears to me to confirm my assumption that the long-continued occlusion diminished the sensitiveness of the nervous acoustic apparatus. I consider that these observations admit of the same explanation[1] as that given of the paracusis Willisii by Johannes Müller, who makes the following assertion in his Physiology: "This phenomenon can proceed from a torpor of the auditory nerve, which must be irritated in order to sharpen its activity."

There is only this difference, that in paracusis Willisii the irritation and improvement are simultaneous, whilst in my experiments they are consecutive.

[1] Ueber eine künstliche Gehörverbesserung bei grossen Trommelfell-Perforationen.—Habilitationsschrift, 1884.

INVESTIGATIONS IN REGARD TO THE INFLUENCE OF THE FORM OF THE CRANIUM UPON SEVERAL IMPORTANT RELATIONS OF THE TEMPORAL BONE.

By OTTO KÖRNER, of FRANKFURT-A.-M.

Translated by Dr. J. M. MILLS, New York.

THREE years ago I published in this journal[1] the discovery that the floor of the middle cranial fossa in brachycephali is deeper than in dolichocephali; and that the sigmoid flexure of the transverse sinus in brachycephali penetrates deeper, forwards and outwards, into the mastoid process and into the base of the pyramid of the petrous bone than in dolichocephali.

As I was well aware of the importance of these relations for the operation of opening the antrum of the mastoid, I requested (at the conclusion of my work) all who possessed suitable material to prove the truth of my statements. Until now no additional investigations have been published, but Politzer[2] has criticised my assertions in the following manner: "As a collection of 60 skulls is entirely too small from which to deduce a general rule, therefore more numerous investigations will be necessary to decide the value of these noteworthy communications."

I believe, however, that, to establish the truth of such relations, it depends not so much upon the number of skulls examined as upon their nature. A collection of skulls of various races were placed at my disposal, in which just the extreme dolichocephalic and the extreme brachy-

[1] Bd. xii., S. 212 *ff.*

[2] "Lehrbuch der Ohrenheilkunde," zweite Aufl., 1887, S. 394.

cephalic forms were abundantly represented. Now, naturally, the law is easily discerned in the comparison of extremes, and the inspection of a brachycephalic and a dolichocephalic skull immediately reveals that which would not have been discovered in the comparison of a large number of mesocephalic skulls. It would be very bad indeed for such a law if it could not be deduced from 60 skulls.

But however that may be, since an authority like Politzer has expressed even a cautious doubt, the matter should be investigated again. Another reason influenced me to verify my previous statements. I have shown in the ARCHIVES OF OTOLOGY,[1] that the fatal intracranial diseases, consequent upon caries of the petrous bone (meningitis, sinus phlebitis, cerebral abscess) more frequently occur on the right—that is, after disease of the right petrous bone—than on the left side. The cause of this can only be due to the fact, which is acknowledged by all (H. von Meyer, Hartmann, Bezold, Rüdinger), that the transverse sinus, at its sigmoid flexure, on the right, enters deeper into the mastoid process and into the base of the pyramid of the petrous bone than on the left, and that therefore the sinus on the right, as well as the contiguous dura mater, with the neighboring portions of the brain, lie nearer to the primary focus of the disease than on the left. Now, if in brachycephali the transverse sinus—without regard to the greater projection on the right side—is situated altogether farther forward than in dolichocephali, and if also the floor of the middle cranial fossa in brachycephali lies deeper—that is, nearer to the primary focus of the disease—than in dolichocephali, then indeed is the assumption justified, that purulent inflammations of the middle ear and caries of the petrous bone in brachycephali more easily result in fatal intracranial disease than in dolichocephali.

Consequently my statements are not only of value in the performance of the operation, but also in regard to the prognosis of disease of the petrous bone, and the indications for the operative treatment.

[1] Bd. xxvii., S, 126.

As regards the performance of the operation, upon the basis of my former investigations, I have advised that the operation be made far forward; in adults with an index of 1.30, and below, if at all possible, it should be made before the line of insertion of the auricle. Gruber[1] does not consider this proposition practical, because then the remaining bony substance of the posterior wall of the auditory canal will be very thin, which retards recovery. I have never noticed any such injurious result. I always round off with a chisel, any sharp edge of bone left on the posterior wall of the auditory canal in making the operation, just as I completely remove an undermined edge of a wound in the bone. If the operation is made far forwards, then we do not incur the risk of opening the diploëtic space when we remove the edge of bone. Several times, after the antrum had already been opened, I have taken away the posterior wall of the bony auricular canal to a considerable depth, and have obtained a better view into the antrum without increasing the danger. Also in such cases the recovery progressed most satisfactorily, without any subsequent cicatricial deformity of the auditory canal.

For further investigations of my statements twenty-nine skulls from the Senckenberg Society of Naturalists' were placed at my disposal. As before, I only received permission to saw through the sagittal median plane. Also in other respects, the method of examination was the same as before. I therefore refer, concerning these, to my first communication.

The recently examined skulls are as follows:

Index.	Number.	Origin.
1.49	1	From Australia.
1.47	1	From South Sea Islands.
1.41	1	Inhabitants of Fiji Islands.
1.39	1	From New Caledonia.
1.37	2	From Bengal, Sandwich Islands.
1.35	3	Inhabitants of Java, of Sumatra, one of unknown origin.
1.29	2	From island of Flores, in East India; negro of unknown origin.

[1] "Lehrbuch der Ohrenheilkunde," Wien, 1888, S. 524.

Index.	Number.	Origin.
1.24	3	Bengal, China, one of unknown origin.
1.22	1	Malay.
1.21		From Mongolia, one of unknown origin.
1.20	4	China, Java, East India, New Zealand.
1.18	1	One of unknown origin.
1.13	1	Siam.
1.12	4	Inhabitants of the Moluccas islands. Two of Java, one of unknown origin.
1.11	1	Island of Madura, in East Indies.
1.10	1	From Mongolia.

The following Table gives the particulars *concerning the position of the middle cranial fossa* in these skulls:

INDEX OF THE SKULL.		1.49-1.40	1.39-1.30	1.29-1.20	1.19-1.10
NUMBER OF SKULLS.		3	6	12	8
		mm	*mm*	*mm*	*mm*
The floor of the middle cranial fossa lies higher than the external auditory canal.	average	10.33	8.33	5.46	5.68
	maximum	13	11	9	7
	minimum	8	7	3	4
The floor of the middle cranial fossa lies higher than the spina supra meatum.	average	14	12.17	7.75	7.12
	maximum	15	15	14	9
	minimum	13	9	5	6

At my previous examination I obtained the following numbers:

INDEX OF SKULL.		1.55-1.40	1.39-1.30	1.29-1.20	1.19-1.07
NUMBER OF SKULLS.		14	15	19	10
		mm	*mm*	*mm*	*mm*
The floor of the middle cranial fossa lies higher than the external auditory canal.	average	11.15	8.8	5.1	4.8
	maximum	17	15	9	7
	minimum	7	4	2	2
The floor of the middle cranial fossa lies higher than the spina supra meatum.	average	15.3	12.1	7.6	5.8
	maximum	17	17	12	9
	minimum	10	7	5	4

The result of the examination of this additional though small series of skulls, confirms completely the proposition made upon the basis of my former examinations:[1]

"*The floor of the middle cranial fossa in dolichocephalic skulls lies higher over the external auditory canal and over the spina supra meatum than in brachycephalic skulls.*"

[1] *A. a. O.*, S. 219.

Also the recently found Maxima and Minima agree with those of the first series of skulls. In the extreme cranial forms the number found in the second series of skulls approximate somewhat to the values found in meso-cranial forms, because the very extreme forms are absent in the second series; whilst the indices of the first series extend from 1.55 to 1.07, those of the second series only include the numbers from 1.49 to 1.10. Furthermore, it is very remarkable that in the recent as well as the old measurements, not only the average numbers but also the maxima and minima found with the higher index, are greater than with the lower (index), and that the difference between the maxima and minima, with the higher index, is greater than with the lower one. From this striking accordance of the old and recent measurements, considered even in detail, we can justly conclude that a law is here established, which could have been deduced from a much smaller number of skulls than were placed at my disposal at my first examination. Combining both tables then, we get the following numbers:

INDEX OF THE SKULL.		1.55-1.40	1.39-1.30	1.29-1.20	1.19-1.07
NUMBER OF SKULLS.		17	21	31	18
		mm	*mm*	*mm*	*mm*
The floor of the middle cranial fossa lies higher than the external auditory canal.	average	11.3	8.7	5.2	5.2
	maximum	17	15	9	7
	minimum	7	4	2	2
The floor of the middle cranial fossa lies higher than the spina supra meatum.	average	15.1	12.1	7.6	6.4
	maximum	17	17	14	9
	minimum	7	7	5	4

I need not repeat what I mentioned before, concerning the *position of the sinus transversus in the region of the temporal bone*, namely, that the sigmoid flexure of the transverse sinus on the right side—independent of the form of the skull—penetrates deeper into the base of the pyramid of the petrous bone and into the mastoid process than on the left; for that is conceded by every one. I desire, however, to advance another theory, that of H. von Meyer, in addition to the previous one of Bezold and Rüdinger, as it seems just as much justified as the others. It was over-

looked by myself and others. Indeed it seems to me very probable that the facts suggested by Bezold and Rüdinger as well as those by v. Meyer, are the combined cause of the projection of the sinus upon the right side. v. Meyer says:[1]

"If we consider only the course of the vessel, then we must regard the innominate vein of the right side as the direct continuation of the jugular vein, the left innominate vein, however, as a direct continuation of the subclavian vein. Furthermore, the superior vena cava as the direct continuation of the right vena innominata, whilst the left innominate vein opens into it on the side. The venous current on the right side, from the base of the skull to the heart, is therefore shorter as well as straighter, whilst the current on the left side is longer by the entire length of the left innominate vein. It is also bent twice at an angle, and therefore strikes against transverse currents into which it has to enter. Consequently the venous stream, on the right side, must not only move much easier, but also the various assisting aspiratory movements will directly influence its circulation. Hence it follows that the longitudinal sinus obtains a much easier exit through the transverse sinus of the right side, and consequently it will become more voluminous."

I further made the assertion that the sigmoid flexure of the transverse sinus on both sides in brachycephali penetrates deeper, *forwards* and *outwards*, into the bone than in dolichocephali. Accurately considered, I have only ascertained, by my measurements,[2] that the sinus in brachycephali lies *farther outwards* than in dolichocephali. The proof that it is also situated farther *forwards* in brachycephali than in dolichocephali could not be obtained by me, as I was only permitted to make sagittal sections through the skull. However, as inspection has taught me, and already before me Bezold and Hartmann, that the transverse sinus sinks into the bone so much farther *forward*, as it presses *outwardly* deeper into the same bone, consequently I can

[1] *Archiv f. Anat. and Physiol., Anat. Theil*, 1887, S. 271.
[2] *L. c.*, S. 221.

consider it demonstrated that the transverse sinus in brachycephali is also situated *farther forward*—that is, penetrates deeper into the bone—than in dolichocephali. The inspection of my skulls also shows that the insertion of the transverse sinus into the bone deeper towards the front is more marked than in the *outward* direction.

Measurements of the distance of the sigmoid fossa from the auditory canal, in different cranial forms, either directly upon horizontal sections made through the auditory canal, or by means of calipers on frontal section made through the auditory canal, have not yet been made, but are very desirable.

ON ATRESIA AURIS CONGENITA.

By Dr. EUGEN JOËL, of Görbersdorf, Silesia.

Translated by Dr. Felix Cohn, New York.

THE results obtained by post-mortem examinations are of such importance in guiding us whether in a given case of atresia auris congenita an operation is feasible or not, that I decided to collect all the recorded cases and publish them together with the case kindly referred to me for examination by Dr. Bezold. I will describe this case at length. The specimen in question is a temporal bone belonging to a female child which died from a right-sided catarrhal pneumonia at the age of a few months.

The temporal bone showed the following abnormities: *A rudimentary auricle; tympanic bone missing; tympanic cavity abnormally small; ossicles and mastoid antrum also missing.*

The temporal bone was removed in the usual manner, the anterior section cutting the upper part of the cartilaginous portion of the tube in a transverse direction. On the auricle, which was cartilaginous in its upper half only, the helix and lobule alone were distinctly recognizable.

The upper part of the helix is greatly enlarged, and merges directly into the skin, so that only a small, free border remains posteriorly and superiorly, through which a probe can be introduced backward and upward into a blind canal to a distance of five *mm.* The lobule is of normal size and normally developed, bearing a shallow depression on its

upper part. On the middle of the rudimentary auricle a similar, small, funnel-shaped depression is observable; this depression is bounded anteriorly and posteriorly by small elevations which correspond in all probability to the tragus and antitragus of the normal auricle, while the depression itself likewise corresponds to an external auditory meatus.

The portion of the Eustachian tube that remained in connection with the temporal bone is normal in appearance; the probe can be introduced through the calibre in the direction of the tube up to a distance of 19 *mm*, at that distance meeting with an osseous obstruction. The tegmen tympani measures but 4 *mm*, half of the usual width; it is lower, and considerably narrower.

The pyramid, porus acusticus internus, the facial and acoustic nerves, are normal; (at the post-mortem the brain was found to be also perfectly normal). The entrance to the fossa subarcuata is reduced to 1 *mm*.

After the tegmen tympani was carefully removed with a chisel, a cancellous osseous tissue was found occupying the space of the tympanic cavity up to a depth of 6 *mm*. At this distance from the tegmen a small aperture presented itself, corresponding to the distal point, up to which the probe had been introduced through the tube; the head of the probe, however, could not be seen; its presence was only noted by a movable reflex at that point, when the probe was moved up and down in the tube. The probe could also be introduced into a small cavity a little below the above-mentioned aperture.

The mastoid process was only very slightly developed; a little anteriorly to the same, a small, irregular quadrilateral plate of bone was found; it was slightly movable and joined in its thicker portion to the squamous portion of the temporal bone; the place of union had not yet been ossified. Its upper surface was horizontal, the lower slightly concave and saddle-shaped. Below this plate a little aperture was visible; from the anterior border of the aperture a cartilaginous mass, 9 *mm* in length, and 2 *mm* in width, was attached to the lower surface of the above-mentioned bone; it served as an articulation for the lower maxilla.

Description of the Temporal Bone after Maceration.

The temporal bone separated into two parts: into the temporal bone proper, the larger portion, and into the small quadrilateral plate already described at length. Of the temporal bone the outer surface is perfectly normal and corresponds in almost every detail to a normal temporal bone. Its mastoid portion merges directly into the squamous portion and into the posterior wall of the auditory canal. The latter forms a furrow with its concavity directed forward and backward. At the junction of the mastoid portion with this auditory furrow a small irregular aperture is visible. In its anterior portion this auditory furrow is covered from above by a trilateral delicate plate of bone, which does not, however, unite with the lower border of the furrow, leaving therefore a fissure which communicates directly with the canal for the tensor tympani and with the adjoining orifice of the Eustachian tube.

The outer wall of the osseous portion of the Eustachian tube is entirely wanting; the tube, being bounded superiorly by a small piece of bone projecting from the tegmen tympani, anteriorly by the wall of the pyramid, and inferiorly by a small horizontal, curved plate of bone projecting from the lower wall of the anterior pyramid.

No sign of the formation of a tympanic bone is found either on the auditory canal or on the tube.

The upper part of the tympanum which is generally traversed by the malleus and incus is entirely missing. The antrum is replaced by a small fissure extending from the tympanic cavity for a short distance immediately behind the narrowed border of the auditory furrow. The tympanum itself is much larger and its internal wall almost normal in appearance. The fenestra ovalis is reduced to about $\frac{1}{3}$ of its natural size. A narrow plate of bone, directed backward, and slightly outward, and gradually forming a furrow with its concavity directed upwards, projects from the promontory towards the outer wall, and is terminated by a small opening corresponding probably to the small aperture which transmits the tendon of the stapedius muscle. Slightly posteriorly and below this small plate of bone, we find the aperture of the fenestra rotunda.

The tympanum runs directly into the canal formed by the osseous portion of the tube. This canal is abnormally wide. The plate of bone which usually separates the semicanalis pro tensore tympani from the tube is missing. Its continuation as well as the processus cochleariformis are also missing. No ossicles were found; whether the stapes was also absent could not be ascertained; it is possible that a small rudiment of bone corresponding in size to the reduced fenestra ovalis might have been present, and have been lost during the process of maceration. Malleus and incus were surely missing, nor could those ossicles have had room in the fissure which was found to replace the normal aditus ad antrum.

The small quadrilateral piece of bone, which has already been described, deserves our especial attention; it was not found in any of the cases already published. As regards form and position it bears the closest resemblance to a bone found by Albrecht[1] in the skull of a new-born child and designated by him as the "os quadratum," a bone commonly found among the lower vertebrates. This bone is considered by the above author to be an equivalent of the inferior part of the squamous portion of the temporal bone, its anatomical function being chiefly the formation of the articulation for the lower maxilla. Gegenbaur,[2] Kölliker,[3] Wiedersheim,[4] and Heuren[5] do not maintain this view, but consider the os quadratum of the lower animals as an equivalent of the incus. The study of our own specimen inclines us to the views of Albrecht with regard to the morphological value of this bone.

I have found only eleven carefully recorded cases of congenital closure, and for the sake of comprehensiveness will here put them together in tabular arrangement with the bibliography subjoined.

---

[1] Über den morphologischen Werth des Unterkiefergelenkes, der Gehörknöchelchen und des mittleren und äusseren Ohres der Säugethiere. By Prof. Dr. Albrecht of Brussels. Basle, 1885.

[2] "Grundzüge der vergleichenden Anatomie." Leipzig, 1870, p. 662.

[3] "Entwickelungsgeschichte des Menschen," p. 486.

[4] "Lehrbuch der vergleichenden Anatomie der Wirbelthiere." Jena, 1882, p. 155.

[5] "Hermann's Handbuch der Physiologie," vol. iii., part second, p. 22.

Author.	Age.	Condition of							Hearing Power.
		Auricle.	Osseous Portion of Auditory Canal.	Auricle.	Tympanum.	Ossicles.	Tube.	Labyrinth.	
Bezold.[1] . . .	8 months.	malformed.	missing.	missing.	smaller.	missing.	present.	normal.	—
(The above case).									
Toynbee.[2] . .	—	"	"	"	narrow fissure.	defective.	normal.	"	—
Lucae.[3] . . .	47 yrs.	"	"	—	rudimentary.	missing.	slightly marked.	defective.	deaf.
Thomson.[4] . .	—	"	"	—	missing.	"	—	missing.	—
Virchow.[5] . .	still-born.	rudimentary.	"	missing.	"	"	rudimentary.	normal.	—
Grawitz.[6] . .	65 yrs.	malformed.	"	—	very small.	defective.	present.	"	deaf.
Moos and Steinbrügge.[7]	2 days old.	"	slightly marked.	missing.	rudimentary.	missing.	slightly marked.	"	—
Truckenbrod.[8]	63 yrs.	"	missing.	—	present.	defective.	very wide.	"	deaf.
Welcker.[9] . .	under 25 yrs.	—	slightly marked.	—	very large.	"	—	not completely normal.	—
Jäger.[10] . . .	60 yrs.	malformed.	missing.	—	very small.	malformed.	normal.	normal.	deaf.
Ranke.[11] . . .	1¼ yrs.	"	"	missing.	missing.	missing.	present.	"	—
Kieselbach.[12]	about 25 yrs.	"	slightly marked.	—	present.	only partly normal.	—	"	—

[1] Jacobson, in the *Archiv für Ohr.*, vol. xix., describes a case of double-sided congenital closure, in which only the left auricle was found to be rudimentary, while the right presented a perfectly normal appearance.

[2] Text-book quoted by Lucæ, *Virchow's Arch.*, vol. xxix., p. 67.

[3] *Virchow's Arch.*, vol. xxix., p. 62.

[4] *Virch. Arch.*, vol. xxx., p. 229.

[5] *Virch Arch.*, vol. xxxii., p. 519.

[6] *Virch. Arch.*, vol. lxxx., p. 454.

[7] *Ztschr. f. Ohrenheilk.*, vol. x., p. 15.

[8] *Ztschr. f. Ohrenheilk.*, vol. x., p. 179.

[9] *Archiv. f. Ohrenheilk.*, vol. i., p. 163.

[10] Ammon's *Zeitschr. f. Ophth.*, vol. v., p. 4.

[11] Gerlach's "Beiträge zur Morphologie und Morphogenie," 1883.

[12] Sitzungsber., d. Münchener Morphol. Ges., 1885, p. 130. A case is also described by Gruber in his "Lehrb. d. Ohrenheilkp., 1888, p. 256.

A study of this table shows us, in the first place; that the different parts of the organ of hearing do not participate equally in the process of malformation; secondly, although

a great similarity exists between most of the cases, there are not even two which present exactly the same pathological condition.

Let us now enter more closely upon the study of the different malformations that were observed: We find, first of all, without any exception, some imperfections in the formation of the auricle, either with regard to its anatomical relations, or in presenting only a slight variation from the normal, or, as in some cases, presenting a complete rudimentary formation. In most cases the rudimentary auricle shows traces of an auditory aperture in the shape of a shallow depression; in some of the recorded cases, however, not even a trace of the formation of a meatus could be found.

In a few specimens the cartilaginons portion of the auditory canal was present, always, however, forming a pouch by being closed at its tympanic end.

The osseous portion of the auditory canal presented a similar condition in almost all the specimens; a mass of compact or cancellous osseous tissue generally took the place of the normal canal; occasionally a small defect in the bone could be observed; in some specimens even a narrow fissure would lead into the tympanum, but in none of the cases was a real auditory canal present.

As the tympanic bone was missing on all the specimens, of course no membrana tympani could have been found; the absence of the tympanic bone therefore fully explains why no membrana tympani was found in the specimens taken from adults.

The tympanum was narrowed by bone tissue in most of the cases; in a few, however, the whole tympanum was replaced by a mass of osseous tissue.

The ossicles presented the greatest variation from the normal. They were either entirely missing, or only some of their processes were wanting; frequently the articulations were ossified. In this connection it is of great importance to note the fact, that not only the malleus and incus—products of the first branchial arch—were found to be abnormally developed, but that the stapes also, a

product, according to Kölliker, of the second arch, was never found normal. The latter showed variations either in regard to shape: sometimes only one branch was present, or there was some change in its base, or in the articulation connecting it with the fenestra ovalis. The Eustachian tube was found normal in a few cases; in other specimens some slight irregularities were present; very frequently the place of communication between the tympanum and the tube was missing.

The labyrinth was rarely affected; variations were found in two specimens only.

It is evident, from the facts here stated, that congenital closure of the external auditory canal is always accompanied by changes in the other parts of the organ of hearing, and changes generally in parts which are contiguous or adjoining. If we study more closely the variations which have been observed, we find that they show a great resemblance to the pathological changes that occur during disease. We find, for instance, stenosis of the external auditory canal, frequently accompanying inflammatory conditions of the surrounding parts. The tympanum also is very often obstructed by hyperplastic connective tissue; the ossicles are frequently rendered immovable by the same inflammatory process, and very frequently they are even completely, or at least in part, destroyed by caries. And one of the most frequent causes, also, of a very high degree of deafness is the fixation of the stapes to the fenestra ovalis. This latter condition has frequently been found present among the specimens of congenital closure.

If we consider furthermore that the fœtal tissues are very frail in comparison with the completely developed organs, we can surely attribute the great changes which we have found in the above tabulated cases to inflammatory conditions during embryonic life. As an organ cannot very well develop normally when such embryonic inflammatory processes are going on, we necessarily obtain deformities and pathological changes, which are due partly to arrest of development, and partly also to the intra-uterine inflammation itself.

It is of importance to the practitioner to determine whether the arrest of development is confined only to the external portion of the ear, or whether the whole organ of hearing has been affected. Formerly an operation, the formation of an artificial canal, was advised in case of congenital closure; I believe that a study of the cases here recorded must show that any operation whatever must be entirely useless. The case of Bonnafont is the only one recorded in which a distinct and lasting improvement was obtained by surgical means. In his case, however, there was no real osseous stenosis of the auditory canal at all, only a dense membrane in front of the membrana tympani.

It is perfectly clear, therefore, that any operation must be useless in those cases where we find an osseous mass in place of the auditory canal.

Besides the difficulty of maintaining an artificial opening for any length of time, we cannot conceive that organs of hearing could perform their functions properly with such changes in the middle ear and in the labyrinth as have been here described.

The cases of malformation which show externally a rudimentary auricle and an atresia of the auditory canal, should be an absolute *noli me tangere* for the surgeon. Nature herself has placed her limits in these cases.

I take this occasion to thank my honored teacher, Prof. Bezold, for his kind assistance in the preparation of this paper.

MISCELLANEOUS NOTES.

The Grand Duke of Baden has distinguished the German co-editor of these ARCHIVES, Prof. **S. Moos**, by conferring on him the title of "Hofrath" (aulic counsellor).

Prof. **Voltolini**, of Breslau, Germany, died, at the age of 70 years, Sept. 10, 1889. His great and successful activity for the advance of the departments which he cultivated, is universally known. He was one of the few who, in study, practice, and teaching, embraced the branches of otology, laryngology, and rhinology, which, at present, are mostly separated. Even in the last years his method of illuminating the larynx and other cavities by transmitted light has produced a great sensation and has been extensively discussed.—*Berl. klin. Woch.*

Editorial Note.—It is intended in future to issue the numbers of these ARCHIVES in January, April, July, and October.

MACEWEN, Successful Operation on a Cerebellar Abscess, 217
Mastoid Abscess without Perforation of the *Mt*, 202
Mastoid Disease, Cases of, 25, 139, 280
Mastoid, Primary Inflammation of, 202
Maxillary Sinus, Anomaly of, 186
Measles, Bacteria in Labyrinth during the, 49, 190
Membrana Tympani, A Case of False, 195; Functions of, 189; Loss of, and Ossicles with Good Hearing, 219
Ménière's Disease, 206
Meningitis from Purulent Invasion of Cranial Cavity, 115
Miscellaneous Notes, 113, 215
MOOS, Bacterial Invasion of the Labyrinth during Measles, 49

Nasal Polypi, 213
Nasal Respiration, 1
Nasal Sounds, Physiology of, 188
Naso-Pharyngeal Disease and Uterine Disturbance, 211
Naso-Pharynx, Anatomy of, 186
Necrosis, Acid Treatment in, of Temporal Bone, 123
Negro, Ear of the, 192
Nervous Apparatus, Therapeutics of, 205
Nose and Naso-Pharynx, Therapeutics of, 208
Nose, Bacteria of the Normal, 209; Diseases of the, 216; Diseases of, and in Ear, 204
Nystagmus during Otitis Media, 199

OLE BULL, Acid Treatment of Temporal Necrosis, 123
Ossicles, Loss of, and Good Hearing, 219; as Transmitters of Sound, 205
Othæmatomata in Foot-Ball Players, 194
Otitis Media, Bacteriology of, 184; from Inflation, 198; Tympanica, 201
Otitis Purulenta and Metastatic Irido-Choroiditis, 199
Otitis Suppurativa, Bacteriology, 198
Otomycosis, Botanical and Clinical Contributions to, 235

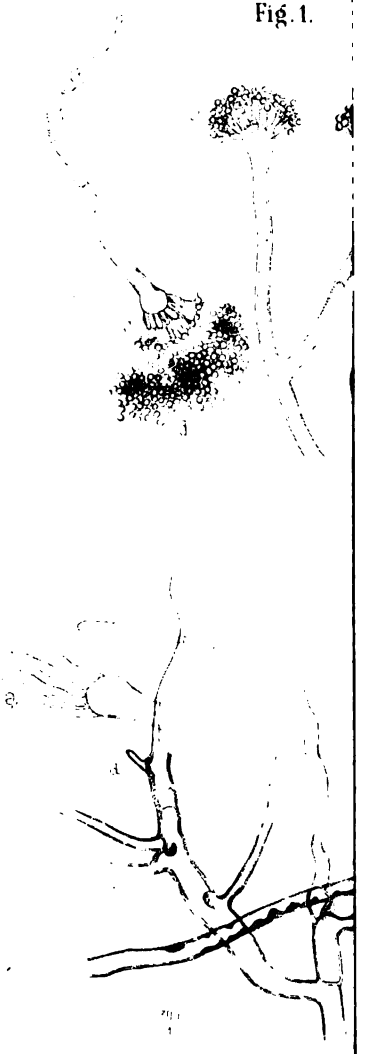
Pachymeningitis Externa after Aural Disease, 201
Pathology and Therapeutics, Report of, 189
Physiology and Physics, Reports on, 187
POLITZER, Dissection of the Ear, 215
Polypus, Treatment of, 199; Cause of Epilepsy, 200

Reports of Progress, 183
Reviews, 101, 215
Rhino-scleroma, 213

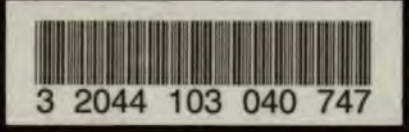
Semicircular Canals, Physiology of 187
Septum, Abscess of Nasal, 211
SEXTON, The Ear and Its Diseases, 109
SIEBENMANN, Contributions to Otomycosis, 235
Smell, Intensity of, 189
Snare for Polypus, 193
Soft Palate, Physiology of, 226
Sphenoid Bone, Physiology of, 188
STEINBRUEGGE, Auditory Reflexes, 274
Syphilis of Ear, 194; of Nose, 211

Techniphone, 193
Temporal Bone, Influenced by Form of Cranium, 310
Tinnitus from Sphenoid Vibration, 187; Nitro-Glycerine in, 204
Tympanum, Projectiles in the, 203

Fig. 1.



NB786


3 2044 103 040 747